

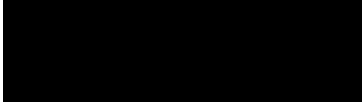


Chris Moore
Sussex Building Consultancy Ltd
3 Northcote Road
Bognor Regis
PO21 5LZ

Therm Energy Limited
45 Graham Road
Worthing
West Sussex
BN11 1TL

Our Reference : DB-01

Sent By : E-Mail


www.thermenergy.co.uk

7 April 2025

Dear Chris

Re : 5 Dwellings, R/O Karenza, Hook Lane, Aldingbourne - Planning (Energy)

The SAP calculations and specifications are attached.

Target Primary Energy (Total) =	27,279 kWh/year
Actual Primary Energy (Total) =	22,225 kWh/year
Saving (Energy) =	5,054 kWh/year = 18.53%

Low and zero carbon (LZC) = Air source heat pumps (PCDB listed, MCS installer)

Conclusion

The total saving from LZCs is over 10%, therefore the proposed meets the requirements of Arun District Council Planning Policy.

The actual energy from LZCs is actually a significantly higher figure, but the above shows the minimum saving against Building Regulations Part L requirements.

If you have any questions, or would like to discuss anything, please do not hesitate to contact us.

Joe Solti (Project Director)

Construction and Insulation

<u>Element</u>	<u>U-Value</u> (W/m ² K)
<u>Exposed Wall</u> (cavity wall) 102.5mm facing brick (or tiles on 100mm block) outer leaf + 50mm clear cavity + reflective breather membrane + external grade plywood + 140mm timber frame (120mm PIR insulation between) + 12.7mm plasterboard (2 layers).	0.18
<u>Exposed Wall</u> (dormers) Cladding + battens + reflective breather membrane + timber frame (120mm PIR insulation between) + 37.5mm insulated plasterboard (25mm PIR insulation + 12.5mm plasterboard).	0.16
<u>Exposed Wall</u> (ashlar walls) Timber frame (120mm PIR insulation between) + 37.5mm insulated plasterboard (25mm PIR insulation + 12.5mm plasterboard).	0.17
<u>Internal Partitions</u> Timber studwork + plasterboard finish both sides.	NA
<u>Party Walls</u> Two skins of 100mm timber frame (fully-filled with 100mm acoustic mineral wool insulation) + 75mm cavity fully-filled with 75mm acoustic mineral wool insulation + 12.7mm plasterboard (2 layers) both sides. Note 1 : Effective edge sealing at all exposed edges, and in line with insulation layers in abutting elements. Note 2 : Therm Energy Can Provide Sound Testing.	0.00
<u>Ground Floor</u> Screed (UFH) + 150mm PIR insulation + suspended concrete beam and block floor.	0.12
<u>First Floor</u> (exposed) 200mm mineral wool insulation quilt (between suspended timber floor joists).	0.20
<u>Roof</u> (roof voids) 400mm mineral wool insulation quilt (100mm between joists + 300mm cross-laid over, or 200mm + 200mm).	0.11
<u>Roof</u> (sloping ceilings) breather membrane (unventilated) 120mm PIR insulation (between rafters) + 37.5mm insulated plasterboard (25mm insulation + 12.5mm plasterboard).	0.17
<u>Windows/French Doors</u> PVC-u frame double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass + warm edge spacer, or similar to achieve U-value of 1.20W/m ² K (or better). BRFC Certified.	1.20
<u>Front Doors</u> PVC-u frame (or composite) double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass + warm edge spacer, or similar to achieve U-value of 0.90W/m ² K (or better).	0.90
<u>Bi-Fold Doors</u> Aluminium thermally-broken frame double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass + warm edge spacer, or similar to achieve U-value of 1.20W/m ² K (or better).	1.20
<u>Rooflights</u> Velux (or equal) timber or PVC-u frame double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass + warm edge spacer.	1.30
Note 1 : U-Value must be frame + glass (not centre-pane). Note 2 : U-value certification will be required from the supplier for the windows, doors & rooflights upon completion. Note 3 : French doors are at least 60% glazed (ie less than 40% is frame).	

Heating, Ventilation & Renewables

Main Heating System

Electric air source heat pump (ground floor = underfloor heating, first floor = radiators). Flow temperature TBC^o.

Note : The heat pumps must be Product Characteristic Database (SAP Appendix Q) listed, or the installer must be MCS certified (or both).

Secondary Heating System

Not applicable.

Water Heating (mains water)

From electric air source heat pump. Hot water cylinder (factory PIR insulation, heat loss TBC kWh/day) + thermostat.

Fully insulated primary pipework.

Heating Controls

Time and temperature zone controls (delayed start room thermostat required in each zone, min 2 zones).

Ventilation

Background ventilators + intermittent extract fans (Approved Document F1, 2021).

Other

Detailing

Block/insulation construction details (limiting thermal bridging and air leakage) fully adopted in accordance with ROI Timber Frame Construction Details.

Electricity Tariff

Standard tariff electric.

Lighting

Low energy lighting with minimum luminous efficacy of 75 light source lumens/circuit-watt (per light fitting).

Water Use

Total water use < 125 litres/person/day.

Air Tightness

Design air permeability is 5m³/h/m² at 50 Pa - to be achieved by air pressure test.

Note : Therm Energy Can Provide Air Leakage Testing.

Photographic Evidence

Building Regulations Part L 2021 (June 2022) requires that the builder/developer collates photographic evidence of all construction elements and junctions throughout the build process. Building Control have the right to request this on completion, and this may be needed to enable the as-built SAP and EPC to be produced, and for us to be able to sign the BREL (compliance) report.

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 07 Apr 2025 15:02:31

Project Information			
Assessed By	Joe Solti	Building Type	House, Detached
OCDEA Registration	EES/003578	Assessment Date	2025-04-07

Dwelling Details			
Assessment Type	As designed	Total Floor Area	110 m ²
Site Reference	DB0101	Plot Reference	DB0101
Address	R/O Karenza Plot 1 Hook Lane, Aldingbourne		

Client Details	
Name	.
Company	.
Address	., ., .

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate

Fuel for main heating system	Electricity
Target carbon dioxide emission rate	9.34 kgCO ₂ /m ²
Dwelling carbon dioxide emission rate	4.23 kgCO ₂ /m ² OK

1b Target primary energy rate and dwelling primary energy

Target primary energy	48.7 kWh _{PE} /m ²
Dwelling primary energy	44.02 kWh _{PE} /m ² OK

1c Target fabric energy efficiency and dwelling fabric energy efficiency

Target fabric energy efficiency	37.1 kWh/m ²
Dwelling fabric energy efficiency	37.0 kWh/m ² OK

2a Fabric U-values

Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.12	Ground Floor (0.12)	OK
Roofs	0.16	0.13	Roof (2) (0.17)	OK
Windows, doors, and roof windows	1.6	1.17	Rooflights (N) (1.3)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))

Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	81.1	0.18
Exposed wall: Walls (2)	10.5	0.17
Sheltered wall: Walls (3)	26.5	0.17
Ground floor: Ground Floor, Ground Floor	64	0.12
Exposed roof: Roof (1)	22.7	0.11
Exposed roof: Roof (2)	21.5	0.17
Exposed roof: Roof (3)	17.7	0.1 (!)

2c Openings (better than typically expected values are flagged with a subsequent (!))

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front Door, Front Door	2.9	North	N/A	0.9 (!)
Windows (N), Windows	5.3	North	1.0	1.2
Windows (S), Windows	3.6	South	1.0	1.2
Windows (E), Windows	1.7	East	1.0	1.2
Bi-Fold Doors, Bi-Fold Doors	4.6	South	0.8	1.2
Rooflights (N), Roof Windows	1.8	North	0.7	1.3
Rooflights (S), Roof Windows	1.2	South	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.144	
External wall	E3: Sill	Calculated by person with suitable expertise	0.048	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.064	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.051	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.13	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.062	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.062	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.062	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m ³ /hm ²		
Dwelling air permeability at 50Pa		5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference				

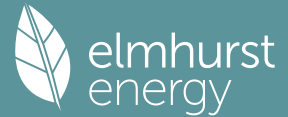
4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	219.3%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	DB0101				Issued on Date	07/04/2025
Assessment Reference	DB0101	Prop Type Ref		New Dwelling		
Property	Plot 1, R/O Karenza, Hook Lane, Aldingbourne, West Sussex					
SAP Rating	81 B	DER	4.23	TER	9.34	
Environmental	96 A	% DER < TER				54.71
CO ₂ Emissions (t/year)	0.42	DFEE	36.97	TFEE	37.13	
Compliance Check	See BREL	% DFEE < TFEE				0.42
% DPER < TPER	9.62	DPER	44.02	TPER	48.70	
Assessor Details	Mr. Joe Solti				Assessor ID	5122-0001
Client	SBC Limited, .					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
First floor	46.3000 (1c)	x 2.3400 (2c)	= 108.3420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.9420 (5)

2. Ventilation rate

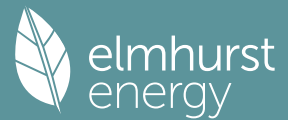
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1527 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4027 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3979	0.3901	0.3823	0.3433	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3511	0.3667 (22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5616	0.5672 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			2.9000	0.9000	2.6100		(26a)
Windows			10.6000	1.1450	12.1374		(27)
Bi-Fold Doors			4.6000	1.1450	5.2672		(27)
Roof Windows			3.0000	1.2357	3.7072		(27a)
Ground Floor			64.0000	0.1200	7.6800	75.0000	4800.0000 (28a)
Wall (cavity)	99.2000	18.1000	81.1000	0.1800	14.5980	18.0000	1459.8000 (29a)
Wall (dormer)	10.5000		10.5000	0.1700	1.7850	18.0000	189.0000 (29a)
Wall (ashlar)	26.5000		26.5000	0.1700	4.5050	18.0000	477.0000 (29a)
Roof (loft)	22.7000		22.7000	0.1100	2.4970	9.0000	204.3000 (30)
Roof (skellings)	24.5000	3.0000	21.5000	0.1700	3.6550	9.0000	193.5000 (30)
Roof (void)	17.7000		17.7000	0.1043	1.8455	9.0000	159.3000 (30)
Total net area of external elements A _{um} (A, m ²)			265.1000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.2873		(33)
Main dwelling							
Internal Wall			190.0000			9.0000	1710.0000 (32c)
Internal Floor			46.3000			18.0000	833.4000 (32d)
Internal Ceiling			46.3000			9.0000	416.7000 (32e)
Heat capacity C _m = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				10443.0000 (34)

Full SAP Calculation Printout



Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

94.6782 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	14.7000	0.1440	2.1168
E2 Other lintels (including other steel lintels)	11.1000	0.0480	0.5328
E3 Sill	28.2000	0.0640	1.8048
E4 Jamb	33.4000	0.0510	1.7034
E5 Ground floor (normal)	31.3000	0.1300	4.0690
E6 Intermediate floor within a dwelling	18.8000	0.0750	1.4100
E10 Eaves (insulation at ceiling level)	6.0000	0.0620	0.3720
E12 Gable (insulation at ceiling level)	7.2000	0.0620	0.4464
E13 Gable (insulation at rafter level)	25.9000	0.0620	1.6058
E16 Corner (normal)	3.1000	0.2400	0.7440
R1 Head of roof window	3.1000	0.2400	0.7440
R2 Sill of roof window	7.8000	0.2400	1.8720
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges	(36a) =	17.4210 (36)
Total fabric heat loss	(33) + (36) + (36a) =	77.7083 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.0641	49.7983	49.5379	48.3144	48.0855	47.0198	47.0198	46.8225	47.4303	48.0855	48.5485	49.0327	(38)
Heat transfer coeff	127.7724	127.5066	127.2462	126.0227	125.7938	124.7281	124.7281	124.5308	125.1386	125.7938	126.2568	126.7410	(39)
Average = Sum(39)m / 12 =												126.0216	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1584	1.1560	1.1536	1.1425	1.1405	1.1308	1.1308	1.1290	1.1345	1.1405	1.1447	1.1491	(40)
HLP (average)												1.1425	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8166 (42)
Hot water usage for mixer showers	80.3758	79.1679	77.4078	74.0401	71.5548	68.7833	67.2079	68.9547	70.8695	73.8454	77.2854	80.0679	(42a)
Hot water usage for baths	30.8470	30.3889	29.7437	28.5542	27.6635	26.6759	26.1424	26.7831	27.4806	28.5374	29.7514	30.7427	(42b)
Hot water usage for other uses	43.4750	41.8940	40.3131	38.7322	37.1513	35.5704	35.5704	37.1513	38.7322	40.3131	41.8940	43.4750	(42c)
Average daily hot water use (litres/day)													142.2265 (43)
Daily hot water use	154.6978	151.4508	147.4647	141.3266	136.3697	131.0296	128.9208	132.8891	137.0824	142.6959	148.9308	154.2855	(44)
Energy conte	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739	(45)
Energy content (annual)										Total = Sum(45)m =		2362.3693	
Distribution loss (46)m = 0.15 x (45)m	36.7505	32.3496	33.9972	29.0203	27.5370	24.1674	23.3878	24.6817	25.3554	29.0455	31.8269	36.2361	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2362.3693	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	81.4636	71.7083	75.3604	64.3284	61.0403	53.5711	51.8429	54.7110	56.2046	64.3843	70.5496	80.3233	(65)

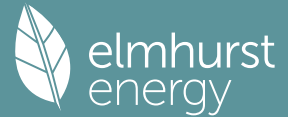
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	140.5621	155.6224	140.5621	145.2475	140.5621	145.2475	140.5621	140.5621	145.2475	140.5621	145.2475	140.5621	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.9863	274.8087	267.6964	252.5552	233.4422	215.4787	203.4779	200.6555	207.7678	222.9090	242.0220	259.9856	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	(71)
Water heating gains (Table 5)	109.4941	106.7087	101.2908	89.3451	82.0434	74.4043	69.6813	73.5363	78.0619	86.5380	97.9856	107.9614	(72)
Total internal gains	590.2918	605.3890	577.7986	555.3971	524.2970	500.3798	478.9706	480.0032	496.3265	518.2584	553.5044	576.7584	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.3000	10.6334	0.6300	0.0000	0.7700	27.3388 (74)
East	1.7000	19.6403	0.6300	0.0000	0.7700	16.1967 (76)
South	3.6000	46.7521	0.6300	0.0000	0.7700	81.6459 (78)
South	4.6000	46.7521	0.6300	0.8000	0.7700	75.1143 (78)

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North	1.8000	15.2954	0.6300	0.7000	1.0000	10.9274 (82)
South	1.2000	47.0123	0.6300	0.7000	1.0000	22.3910 (82)

Solar gains	233.6141	400.9679	562.3322	728.9585	852.5604	864.0416	825.5533	729.4640	618.8051	446.3064	280.2320	199.7297 (83)
Total gains	823.9059	1006.3569	1140.1308	1284.3555	1376.8574	1364.4213	1304.5239	1209.4672	1115.1316	964.5647	833.7364	776.4881 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.7031	22.7504	22.7970	23.0183	23.0602	23.2572	23.2572	23.2941	23.1810	23.0602	22.9757	22.8879
alpha	2.5135	2.5167	2.5198	2.5346	2.5373	2.5505	2.5505	2.5529	2.5454	2.5373	2.5317	2.5259
util living area	0.9418	0.9077	0.8608	0.7756	0.6568	0.5124	0.3926	0.4338	0.6215	0.8162	0.9140	0.9488 (86)
MIT	18.9391	19.2499	19.6432	20.1199	20.4977	20.7370	20.8272	20.8107	20.6343	20.1307	19.4542	18.8836 (87)
Th 2	19.9534	19.9554	19.9573	19.9662	19.9679	19.9758	19.9758	19.9772	19.9727	19.9679	19.9645	19.9610 (88)
util rest of house	0.9338	0.8956	0.8424	0.7459	0.6113	0.4470	0.3103	0.3496	0.5583	0.7849	0.9006	0.9417 (89)
MIT 2	17.5419	17.9315	18.4213	19.0068	19.4473	19.7098	19.7918	19.7815	19.6110	19.0361	18.2011	17.4772 (90)
Living area fraction									fLA = Living area / (4) =			0.1387 (91)
MIT	17.7357	18.1144	18.5908	19.1612	19.5930	19.8523	19.9354	19.9243	19.7529	19.1879	18.3749	17.6723 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7357	18.1144	18.5908	19.1612	19.5930	19.8523	19.9354	19.9243	19.7529	19.1879	18.3749	17.6723 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9111	0.8684	0.8133	0.7195	0.5931	0.4386	0.3069	0.3450	0.5434	0.7567	0.8740	0.9206 (94)
Useful gains	750.6546	873.9647	927.2470	924.1205	816.6602	598.4982	400.3910	417.2738	605.9974	729.8491	728.7042	714.8028 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1716.7134	1684.9257	1538.5054	1293.1477	992.8913	655.1049	416.0226	438.8846	707.3982	1080.3089	1423.5380	1707.4883 (97)
Space heating kWh	718.7477	544.9657	454.7762	265.6995	131.1159	0.0000	0.0000	0.0000	0.0000	260.7421	500.2804	738.5580 (98a)
Space heating requirement - total per year (kWh/year)												3614.8856
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	718.7477	544.9657	454.7762	265.6995	131.1159	0.0000	0.0000	0.0000	0.0000	260.7421	500.2804	738.5580 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3614.8856
Space heating per m2										(98c) / (4) =		32.7732 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	718.7477	544.9657	454.7762	265.6995	131.1159	0.0000	0.0000	0.0000	0.0000	260.7421	500.2804	738.5580 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	327.7463	248.5024	207.3763	121.1580	59.7884	0.0000	0.0000	0.0000	0.0000	118.8974	228.1260	336.7798 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	128.6783	113.2689	119.0377	101.6119	96.4180	84.6198	81.8900	86.4204	88.7795	101.7001	111.4387	126.8770 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	29.8826	23.9729	21.5850	15.8141	12.2152	9.9800	11.1431	14.4843	18.8137	24.6845	27.8811	30.7131 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1648.3746 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1240.7402 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	241.1696 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3130.2844 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1648.3746	0.1551	255.6415 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1240.7402	0.1416	175.6618 (264)
Space and water heating			431.3032 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	241.1696	0.1443	34.8082 (268)
Total CO2, kg/year			466.1115 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.2300 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1648.3746	1.5742	2594.7939 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1240.7402	1.5235	1890.3154 (278)
Space and water heating			4485.1093 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	241.1696	1.5338	369.9140 (282)
Total Primary energy kWh/year			4855.0233 (286)
Dwelling Primary energy Rate (DPER)			44.0200 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
First floor	46.3000 (1c)	x 2.3400 (2c)	= 108.3420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.9420 (5)

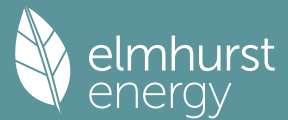
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1527 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000 (17)	
Infiltration rate		0.4027 (18)	
Number of sides sheltered		3 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3121 (21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3979	0.3901	0.3823	0.3433	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3511	0.3667 (22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5616	0.5672 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			2.9000	1.0000	2.9000			(26a)
TER Opening Type			15.2000	1.1450	17.4046			(27)
TER Roof Window			3.0000	1.1450	4.2453			(27a)
Ground Floor			64.0000	0.1300	8.3200			(28a)
Wall (cavity)	99.2000	18.1000	81.1000	0.1800	14.5980			(29a)
Wall (dormer)	10.5000		10.5000	0.1800	1.8900			(29a)
Wall (ashlar)	26.5000		26.5000	0.1800	4.7700			(29a)
Roof (loft)	22.7000		22.7000	0.1100	2.4970			(30)
Roof (skellings)	24.5000	3.0000	21.5000	0.1100	2.3650			(30)
Roof (void)	17.7000		17.7000	0.1100	1.9470			(30)
Total net area of external elements Aum (A, m2)			265.1000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		60.9369			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

94.6782 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.7000	0.0500	0.7350
E3 Sill	11.1000	0.0500	0.5550
E4 Jamb	28.2000	0.0500	1.4100
E5 Ground floor (normal)	33.4000	0.1600	5.3440
E6 Intermediate floor within a dwelling	31.3000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	18.8000	0.0600	1.1280
E12 Gable (insulation at ceiling level)	6.0000	0.0600	0.3600
E13 Gable (insulation at rafter level)	7.2000	0.0800	0.5760
E16 Corner (normal)	25.9000	0.0900	2.3310
R1 Head of roof window	3.1000	0.0800	0.2480
R2 Sill of roof window	3.1000	0.0600	0.1860
R3 Jamb of roof window	7.8000	0.0800	0.6240

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

13.4970 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 74.4339 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.0641	49.7983	49.5379	48.3144	48.0855	47.0198	47.0198	46.8225	47.4303	48.0855	48.5485	49.0327	(38)
Heat transfer coeff	124.4979	124.2322	123.9717	122.7482	122.5193	121.4537	121.4537	121.2564	121.8642	122.5193	122.9824	123.4665	(39)
Average = Sum(39)m / 12 =												122.7471	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1263	1.1240	1.1129	1.1108	1.1011	1.1011	1.0993	1.1048	1.1108	1.1150	1.1194	(40)
HLP (average)												1.1128	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

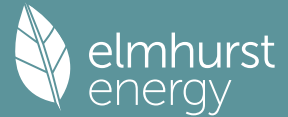
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8166 (42)
Hot water usage for mixer showers													
71.4452	70.3715	68.8069	65.8134	63.6043	61.1407	59.7404	61.2931	62.9952	65.6403	68.6981	71.1714	(42a)	
Hot water usage for baths													
30.8470	30.3889	29.7437	28.5542	27.6635	26.6759	26.1424	26.7831	27.4806	28.5374	29.7514	30.7427	(42b)	
Hot water usage for other uses													
43.4750	41.8940	40.3131	38.7322	37.1513	35.5704	35.5704	37.1513	38.7322	40.3131	41.8940	43.4750	(42c)	
Average daily hot water use (litres/day)												133.9928 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7671	142.6544	138.8638	133.0999	128.4191	123.3870	121.4532	125.2275	129.2080	134.4908	140.3436	145.3891	(44)
Energy content (annual)	230.8595	203.1380	213.4285	182.2071	172.8769	151.7187	146.8871	155.0578	159.3263	182.5028	199.9451	227.6442	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2225.5919	
34.6289	30.4707	32.0143	27.3311	25.9315	22.7578	22.0331	23.2587	23.8990	27.3754	29.9918	34.1466	(46)	
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.3938 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7527 (55)
Total storage loss													
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	(56)
If cylinder contains dedicated solar storage													
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
277.4544	245.2237	260.0234	227.2989	219.4718	196.8105	193.4820	201.6527	204.4182	229.0977	245.0370	274.2391	274.2391	(62)
WWHRS	-32.6618	-28.8863	-30.2481	-25.0466	-23.3425	-19.9744	-18.7228	-19.9098	-20.6663	-24.3632	-27.6006	-32.0569	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
244.7926	216.3374	229.7753	202.2523	196.1292	176.8362	174.7592	181.7428	183.7519	204.7344	217.4364	242.1822	242.1822	(64)
12Total per year (kWh/year)													
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
114.0367	101.2120	108.2409	96.6573	94.7575	86.5199	86.1159	88.8326	89.0495	97.9581	102.5552	112.9676	112.9676	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
141.4028	156.5531	141.4028	146.1162	141.4028	146.1162	141.4028	141.4028	146.1162	141.4028	146.1162	141.4028	141.4028	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
271.9863	274.8087	267.6964	252.5552	233.4422	215.4787	203.4779	200.6555	207.7678	222.9090	242.0220	259.9856	259.9856	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

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Losses e.g. evaporation (negative values) (Table 5)	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646 (71)
Water heating gains (Table 5)	153.2751	150.6130	145.4851	134.2463	127.3622	120.1666	115.7472	119.3987	123.6798	131.6641	142.4378	151.8382 (72)
Total internal gains	634.9135	650.2241	622.8335	601.1670	570.4564	547.0107	525.8771	526.7062	542.8131	564.2251	598.8253	621.4758 (73)

6. Solar gains

[Jan]												Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North												5.3000	10.6334		0.6300		0.7000		0.7700		17.2234 (74)		
East												1.7000	19.6403		0.6300		0.7000		0.7700		10.2039 (76)		
South												8.2000	46.7521		0.6300		0.7000		0.7700		117.1619 (78)		
North												1.8000	15.2954		0.6300		0.7000		1.0000		10.9274 (82)		
South												1.2000	47.0123		0.6300		0.7000		1.0000		22.3910 (82)		
Solar gains	177.9077	305.0620	427.5681	554.6721	649.6830	658.9959	629.3998	555.3718	470.5615	339.4361	213.3437	152.1523	(83)										
Total gains	812.8212	955.2860	1050.4017	1155.8391	1220.1394	1206.0066	1155.2769	1082.0780	1013.3746	903.6613	812.1689	773.6281	(84)										

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	23.3003	23.3501	23.3992	23.6324	23.6765	23.8843	23.8843	23.9231	23.8038	23.6765	23.5874	23.4949
alpha	2.5534	2.5567	2.5599	2.5755	2.5784	2.5923	2.5923	2.5949	2.5869	2.5784	2.5725	2.5663
util living area	0.9426	0.9149	0.8767	0.8036	0.6955	0.5521	0.4266	0.4662	0.6511	0.8306	0.9168	0.9486 (86)
MIT	18.4731	18.8307	19.3099	19.9230	20.4366	20.7832	20.9193	20.8962	20.6486	19.9856	19.1338	18.4116 (87)
Th 2	19.9774	19.9794	19.9813	19.9903	19.9920	19.9999	19.9999	20.0014	19.9969	19.9920	19.9886	19.9850 (88)
util rest of house	0.9348	0.9036	0.8601	0.7764	0.6519	0.4862	0.3411	0.3798	0.5895	0.8011	0.9039	0.9415 (89)
MIT 2	17.0336	17.4826	18.0817	18.8380	19.4438	19.8266	19.9528	19.9372	19.6948	18.9312	17.8766	16.9606 (90)
Living area fraction	17.2333	17.6696	18.2521	18.9885	19.5815	19.9593	20.0868	20.0702	19.8271	19.0775	18.0510	0.1387 (91)
MIT	17.2333	17.6696	18.2521	18.9885	19.5815	19.9593	20.0868	20.0702	19.8271	19.0775	18.0510	17.1619 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2333	17.6696	18.2521	18.9885	19.5815	19.9593	20.0868	20.0702	19.8271	19.0775	18.0510	17.1619 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9052	0.8698	0.8245	0.7447	0.6322	0.4833	0.3489	0.3861	0.5779	0.7687	0.8707	0.9135 (94)
Ext temp.	735.7654	830.8989	866.0214	860.7283	771.3164	582.9222	403.0399	417.7978	585.6762	694.6222	707.1605	706.7452 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1610.1714	1586.3958	1456.9221	1238.3506	965.6420	650.9097	423.4893	445.0394	697.9332	1038.6548	1346.7772	1600.3556 (97)
Space heating requirement - total per year (kWh/year)	650.5580	507.6939	439.6301	271.8881	144.5782	0.0000	0.0000	0.0000	0.0000	255.9602	460.5240	664.8462 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98c)
Space heating kWh	650.5580	507.6939	439.6301	271.8881	144.5782	0.0000	0.0000	0.0000	0.0000	255.9602	460.5240	664.8462 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3395.6786 (99)
Space heating per m ²										(98c) / (4) =		30.7858 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	650.5580	507.6939	439.6301	271.8881	144.5782	0.0000	0.0000	0.0000	0.0000	255.9602	460.5240	664.8462 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	704.8299	550.0476	476.3056	294.5699	156.6395	0.0000	0.0000	0.0000	0.0000	277.3133	498.9425	720.3100 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	244.7926	216.3374	229.7753	202.2523	196.1292	176.8362	174.7592	181.7428	183.7519	204.7344	217.4364	242.1822 (64)
Efficiency of water heater (217)m	86.1438	85.9051	85.4904	84.7240	83.3863	79.8000	79.8000	79.8000	79.8000	84.5617	85.7001	79.8000 (216)
Fuel for water heating, kWh/month	284.1676	251.8330	268.7731	238.7190	235.2056	221.5992	218.9965	227.7479	230.2656	242.1125	253.7178	280.9405 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	29.3807	23.5703	21.2224	15.5485	12.0101	9.8123	10.9560	14.2410	18.4977	24.2700	27.4129	30.1973 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-55.7963	-76.6589	-107.3977	-117.5636	-124.0999	-114.8269	-113.3249	-108.2201	-98.9113	-86.0534	-60.5916	-48.4708 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-37.9123	-78.9280	-155.4113	-231.3663	-304.0181	-304.8424	-301.3239	-256.0539	-188.8701	-112.2619	-50.4072	-30.0495	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3678.9584	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2954.0782	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												237.1192	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3163.3603	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3792.7954	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3678.9584	0.2100	772.5813	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2954.0782	0.2100	620.3564	(264)
Space and water heating			1392.9377	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	237.1192	0.1443	34.2236	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1111.9154	0.1352	-150.2843	
PV Unit electricity exported	-2051.4449	0.1262	-258.7960	
Total			-409.0803	(269)
Total CO2, kg/year			1030.0102	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.3400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3678.9584	1.1300	4157.2230	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2954.0782	1.1300	3338.1083	(278)
Space and water heating			7495.3314	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	237.1192	1.5338	363.7013	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1111.9154	1.4996	-1667.3761	
PV Unit electricity exported	-2051.4449	0.4631	-949.9824	
Total			-2617.3585	(283)
Total Primary energy kWh/year			5371.7749	(286)
Target Primary Energy Rate (TPER)			48.7000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

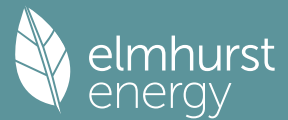
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Main dwelling				
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)	
First floor	46.3000 (1c)	x 2.3400 (2c)	= 108.3420 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.3000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.9420 (5)	

2. Ventilation rate

	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)

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Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000	Air changes per hour	0.1527 (8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				5.0000	(17)
Infiltration rate				0.4027	(18)
Number of sides sheltered				3	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3121	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3979	0.3901	0.3823	0.3433	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3511	0.3667	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5616	0.5672	(25)

3. Heat losses and heat loss parameter

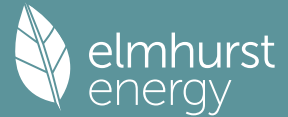
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Front Door			2.9000	0.9000	2.6100		(26a)
Windows			10.6000	1.1450	12.1374		(27)
Bi-Fold Doors			4.6000	1.1450	5.2672		(27)
Roof Windows			3.0000	1.2357	3.7072		(27a)
Ground Floor			64.0000	0.1200	7.6800	75.0000	4800.0000 (28a)
Wall (cavity)	99.2000	18.1000	81.1000	0.1800	14.5980	18.0000	1459.8000 (29a)
Wall (dormer)	10.5000		10.5000	0.1700	1.7850	18.0000	189.0000 (29a)
Wall (ashlar)	26.5000		26.5000	0.1700	4.5050	18.0000	477.0000 (29a)
Roof (loft)	22.7000		22.7000	0.1100	2.4970	9.0000	204.3000 (30)
Roof (skellings)	24.5000	3.0000	21.5000	0.1700	3.6550	9.0000	193.5000 (30)
Roof (void)	17.7000		17.7000	0.1043	1.8455	9.0000	159.3000 (30)
Total net area of external elements Aum(A, m2)			265.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.2873		(33)
Main dwelling							
Internal Wall			190.0000			9.0000	1710.0000 (32c)
Internal Floor			46.3000			18.0000	833.4000 (32d)
Internal Ceiling			46.3000			9.0000	416.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10443.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							94.6782 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				14.7000	0.1440	2.1168	
E3 Sill				11.1000	0.0480	0.5328	
E4 Jamb				28.2000	0.0640	1.8048	
E5 Ground floor (normal)				33.4000	0.0510	1.7034	
E6 Intermediate floor within a dwelling				31.3000	0.1300	4.0690	
E10 Eaves (insulation at ceiling level)				18.8000	0.0750	1.4100	
E12 Gable (insulation at ceiling level)				6.0000	0.0620	0.3720	
E13 Gable (insulation at rafter level)				7.2000	0.0620	0.4464	
E16 Corner (normal)				25.9000	0.0620	1.6058	
R1 Head of roof window				3.1000	0.2400	0.7440	
R2 Sill of roof window				3.1000	0.2400	0.7440	
R3 Jamb of roof window				7.8000	0.2400	1.8720	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.4210 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	77.7083 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	50.0641	49.7983	49.5379	48.3144	48.0855	47.0198	47.0198	46.8225	47.4303	48.0855	48.5485	49.0327	(38)
Average = Sum(39)m / 12 =	127.7724	127.5066	127.2462	126.0227	125.7938	124.7281	124.7281	124.5308	125.1386	125.7938	126.2568	126.7410	(39)
												126.0216	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1584	1.1560	1.1536	1.1425	1.1405	1.1308	1.1308	1.1290	1.1345	1.1405	1.1447	1.1491	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8166 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	30.8470	30.3889	29.7437	28.5542	27.6635	26.6759	26.1424	26.7831	27.4806	28.5374	29.7514	30.7427	(42b)
Hot water usage for other uses	43.4750	41.8940	40.3131	38.7322	37.1513	35.5704	35.5704	37.1513	38.7322	40.3131	41.8940	43.4750	(42c)
Average daily hot water use (litres/day)													68.1227 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	74.3219	72.2829	70.0569	67.2865	64.8149	62.2463	61.7129	63.9344	66.2128	68.8505	71.6454	74.2177	(44)
Energy content (annual)	117.7078	102.9299	107.6748	92.1118	87.2533	76.5391	74.6364	79.1641	81.6470	93.4295	102.0720	116.2069	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												0.0000 (61)
100.0516	87.4904	91.5236	78.2950	74.1653	65.0583	63.4409	67.2895	69.4000	79.4151	86.7612	98.7759	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
100.0516	87.4904	91.5236	78.2950	74.1653	65.0583	63.4409	67.2895	69.4000	79.4151	86.7612	98.7759	(64)
12Total per year (kWh/year)												961.6667 (64)
Electric shower(s)												962 (64)
57.2157	50.9796	55.6678	53.1231	54.1200	51.6252	53.3460	54.1200	53.1231	55.6678	54.6210	57.2157	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												650.8250 (64a)
Heat gains from water heating, kWh/month												
39.3168	34.6175	36.7978	32.8545	32.0713	29.1709	29.1967	30.3524	30.6308	33.7707	35.3456	38.9979	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
140.5621	155.6224	140.5621	145.2475	140.5621	145.2475	140.5621	140.5621	145.2475	140.5621	145.2475	140.5621	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
271.9863	274.8087	267.6964	252.5552	233.4422	215.4787	203.4779	200.6555	207.7678	222.9090	242.0220	259.9856	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	(71)
Water heating gains (Table 5)												
52.8452	51.5142	49.4595	45.6313	43.1066	40.5151	39.2429	40.7962	42.5427	45.3908	49.0911	52.4165	(72)
Total internal gains												
530.6429	547.1945	522.9673	508.6833	482.3602	466.4905	448.5322	447.2631	460.8073	474.1111	501.6099	518.2135	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	

North					5.3000	10.6334		0.6300	0.0000	0.7700		27.3388 (74)	
East					1.7000	19.6403		0.6300	0.0000	0.7700		16.1967 (76)	
South					3.6000	46.7521		0.6300	0.0000	0.7700		81.6459 (78)	
South					4.6000	46.7521		0.6300	0.8000	0.7700		75.1143 (78)	
North					1.8000	15.2954		0.6300	0.7000	1.0000		10.9274 (82)	
South					1.2000	47.0123		0.6300	0.7000	1.0000		22.3910 (82)	

Solar gains	233.6141	400.9679	562.3322	728.9585	852.5604	864.0416	825.5533	729.4640	618.8051	446.3064	280.2320	199.7297	(83)
Total gains	764.2570	948.1623	1085.2995	1237.6418	1334.9206	1330.5321	1274.0855	1176.7271	1079.6124	920.4175	781.8419	717.9432	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.7031	22.7504	22.7970	23.0183	23.0602	23.2572	23.2572	23.2941	23.1810	23.0602	22.9757	22.8879
alpha	2.5135	2.5167	2.5198	2.5346	2.5373	2.5505	2.5505	2.5529	2.5454	2.5373	2.5317	2.5259
util living area	0.9500	0.9175	0.8721	0.7873	0.6686	0.5220	0.4006	0.4437	0.6340	0.8293	0.9240	0.9565 (86)
MIT	18.3194	18.7456	19.2860	19.9458	20.4683	20.8006	20.9262	20.9024	20.6563	19.9556	19.0242	18.2439 (87)
Th 2	19.9534	19.9554	19.9573	19.9662	19.9679	19.9758	19.9758	19.9772	19.9727	19.9679	19.9645	19.9610 (88)
util rest of house	0.9430	0.9064	0.8548	0.7585	0.6233	0.4562	0.3171	0.3582	0.5710	0.7993	0.9119	0.9503 (89)
MIT 2	17.5172	17.9347	18.4605	19.0932	19.5694	19.8536	19.9429	19.9311	19.7453	19.1194	18.2207	17.4480 (90)
Living area fraction	fLA = Living area / (4) = 0.1387 (91)											
MIT	17.6285	18.0472	18.5750	19.2114	19.6941	19.9850	20.0793	20.0659	19.8716	19.2354	18.3321	17.5584 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6285	18.0472	18.5750	19.2114	19.6941	19.9850	20.0793	20.0659	19.8716	19.2354	18.3321	17.5584 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9217	0.8803	0.8267	0.7343	0.6102	0.4568	0.3259	0.3660	0.5642	0.7739	0.8868	0.9307 (94)
Useful gains	704.4521	834.7126	897.2688	908.8404	814.5771	607.8498	415.2083	430.7068	609.1161	712.2975	693.3474	668.1690 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1703.0150	1676.3559	1536.4972	1299.4755	1005.6054	671.6610	433.9679	456.5113	722.2541	1086.2831	1418.1335	1693.0617 (97)
Space heating kWh	742.9307	565.5843	475.5860	281.2572	142.1251	0.0000	0.0000	0.0000	0.0000	278.2452	521.8460	762.5202 (98a)
Space heating requirement - total per year (kWh/year)												3770.0948
Solar heating kWh	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	742.9307	565.5843	475.5860	281.2572	142.1251	0.0000	0.0000	0.0000	0.0000	278.2452	521.8460	762.5202 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3770.0948
Space heating per m2											(98c) / (4) =	34.1804 (99)

8c. Space cooling requirement

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Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1172.4444	922.9882	946.4340	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7926	0.8478	0.8204	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	929.2353	782.5380	776.4107	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1462.9321	1401.7376	1296.3472	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	384.2617	460.6845	386.8328	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	96.0654	115.1711	96.7082	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling requirement												307.9447 (107)
Energy for space heating												34.1804 (99)
Energy for space cooling												2.7919 (108)
Total												36.9723 (109)
Fabric Energy Efficiency (DFEE)												37.0 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
First floor	46.3000 (1c)	x 2.3400 (2c)	= 108.3420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.9420 (5)

2. Ventilation rate

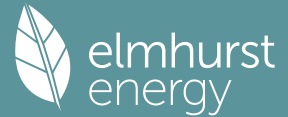
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1527 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4027 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3979	0.3901	0.3823	0.3433	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3511	0.3667 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5616	0.5672 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
TER Semi-glazed door			2.9000	1.0000	2.9000		(26a)
TER Opening Type			15.2000	1.1450	17.4046		(27)
TER Roof Window			3.0000	1.1450	4.2453		(27a)
Ground Floor			64.0000	0.1300	8.3200		(28a)
Wall (cavity)	99.2000	18.1000	81.1000	0.1800	14.5980		(29a)
Wall (dormer)	10.5000		10.5000	0.1800	1.8900		(29a)
Wall (ashlar)	26.5000		26.5000	0.1800	4.7700		(29a)
Roof (loft)	22.7000		22.7000	0.1100	2.4970		(30)
Roof (skellings)	24.5000	3.0000	21.5000	0.1100	2.3650		(30)
Roof (void)	17.7000		17.7000	0.1100	1.9470		(30)
Total net area of external elements Aum(A, m ²)			265.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.9369		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							94.6782 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				14.7000	0.0500	0.7350	
E3 Sill				11.1000	0.0500	0.5550	
E4 Jamb				28.2000	0.0500	1.4100	

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E5 Ground floor (normal)	33.4000	0.1600	5.3440
E6 Intermediate floor within a dwelling	31.3000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	18.8000	0.0600	1.1280
E12 Gable (insulation at ceiling level)	6.0000	0.0600	0.3600
E13 Gable (insulation at rafter level)	7.2000	0.0800	0.5760
E16 Corner (normal)	25.9000	0.0900	2.3310
R1 Head of roof window	3.1000	0.0800	0.2480
R2 Sill of roof window	3.1000	0.0600	0.1860
R3 Jamb of roof window	7.8000	0.0800	0.6240
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.4970 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	74.4339 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.0641	49.7983	49.5379	48.3144	48.0855	47.0198	47.0198	46.8225	47.4303	48.0855	48.5485	49.0327 (38)
Average = Sum(39)m / 12 =	124.4979	124.2322	123.9717	122.7482	122.5193	121.4537	121.4537	121.2564	121.8642	122.5193	122.9824	123.4665 (39)
												122.7471
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1287	1.1263	1.1240	1.1129	1.1108	1.1011	1.1011	1.0993	1.1048	1.1108	1.1150	1.1194 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8166 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	30.8470	30.3889	29.7437	28.5542	27.6635	26.6759	26.1424	26.7831	27.4806	28.5374	29.7514	30.7427 (42b)
Hot water usage for other uses	43.4750	41.8940	40.3131	38.7322	37.1513	35.5704	35.5704	37.1513	38.7322	40.3131	41.8940	43.4750 (42c)
Average daily hot water use (litres/day)												68.1227 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	74.3219	72.2829	70.0569	67.2865	64.8149	62.2463	61.7129	63.9344	66.2128	68.8505	71.6454	74.2177 (44)
Energy content (annual)	117.7078	102.9299	107.6748	92.1118	87.2533	76.5391	74.6364	79.1641	81.6470	93.4295	102.0720	116.2069 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS	100.0516	87.4904	91.5236	78.2950	74.1653	65.0583	63.4409	67.2895	69.4000	79.4151	86.7612	98.7759 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	100.0516	87.4904	91.5236	78.2950	74.1653	65.0583	63.4409	67.2895	69.4000	79.4151	86.7612	98.7759 (64)
12Total per year (kWh/year)												961.6667 (64)
Electric shower(s)	57.2157	50.9796	55.6678	53.1231	54.1200	51.6252	53.3460	54.1200	53.1231	55.6678	54.6210	57.2157 (64a)
Heat gains from water heating, kWh/month	39.3168	34.6175	36.7978	32.8545	32.0713	29.1709	29.1967	30.3524	30.6308	33.7707	35.3456	38.9979 (65)

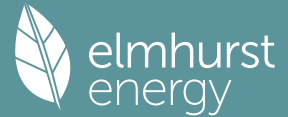
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307	140.8307 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	141.4028	156.5531	141.4028	146.1162	141.4028	146.1162	141.4028	141.4028	146.1162	141.4028	146.1162	141.4028 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	271.9863	274.8087	267.6964	252.5552	233.4422	215.4787	203.4779	200.6555	207.7678	222.9090	242.0220	259.9856 (68)
Pumps, fans	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831	37.0831 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646 (71)
Total internal gains	52.8452	51.5142	49.4595	45.6313	43.1066	40.5151	39.2429	40.7962	42.5427	45.3908	49.0911	52.4165 (72)
	531.4836	548.1252	523.8079	509.5520	483.2008	467.3592	449.3728	448.1037	461.6760	474.9518	502.4785	519.0541 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.3000	10.6334	0.6300	0.7000	0.7700	17.2234 (74)
East	1.7000	19.6403	0.6300	0.7000	0.7700	10.2039 (76)
South	8.2000	46.7521	0.6300	0.7000	0.7700	117.1619 (78)
North	1.8000	15.2954	0.6300	0.7000	1.0000	10.9274 (82)
South	1.2000	47.0123	0.6300	0.7000	1.0000	22.3910 (82)
Solar gains	177.9077	305.0620	427.5681	554.6721	649.6830	658.9959
Total gains	709.3912	853.1872	951.3761	1064.2241	1132.8838	1126.3551
						1078.7726
						1003.4755
						932.2375
						814.3879
						715.8222
						152.1523 (83)
						671.2065 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.3003	23.3501	23.3992	23.6324	23.6765	23.8843	23.8843	23.9231	23.8038	23.6765	23.5874	23.4949
alpha	2.5534	2.5567	2.5599	2.5755	2.5784	2.5923	2.5923	2.5949	2.5869	2.5784	2.5725	2.5663
util living area	0.9568	0.9318	0.8970	0.8275	0.7226	0.5790	0.4514	0.4946	0.6831	0.8575	0.9352	0.9619 (86)
MIT	18.3048	18.6785	19.1796	19.8296	20.3786	20.7568	20.9077	20.8805	20.6038	19.8845	18.9884	18.2413 (87)
Th 2	19.9774	19.9794	19.9813	19.9903	19.9920	19.9999	19.9999	20.0014	19.9969	19.9920	19.9886	19.9850 (88)
util rest of house	0.9506	0.9224	0.8824	0.8022	0.6803	0.5124	0.3625	0.4053	0.6224	0.8311	0.9246	0.9565 (89)
MIT 2	17.5189	17.8867	18.3776	19.0079	19.5169	19.8469	19.9575	19.9431	19.7282	19.0741	18.2030	17.4613 (90)
Living area fraction	17.6279	17.9965	18.4888	19.1219	19.6365	19.9731	20.0893	20.0731	19.8497	19.1865	18.3119	17.5695 (92)
Temperature adjustment	17.6279	17.9965	18.4888	19.1219	19.6365	19.9731	20.0893	20.0731	19.8497	19.1865	18.3119	17.5695 (93)
adjusted MIT	17.6279	17.9965	18.4888	19.1219	19.6365	19.9731	20.0893	20.0731	19.8497	19.1865	18.3119	17.5695 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9313	0.8985	0.8556	0.7767	0.6636	0.5105	0.3709	0.4121	0.6124	0.8054	0.9015	0.9386 (94)
Useful gains	660.6270	766.5662	814.0370	826.6259	751.7618	574.9712	400.1294	413.5726	570.9441	655.9389	645.3069	629.9822 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1659.2945	1627.0117	1486.2767	1254.7170	972.3687	652.5870	423.7860	445.3866	700.6773	1052.0166	1378.8717	1650.6801 (97)
Space heating kWh	743.0086	578.2194	500.1463	308.2256	164.1315	0.0000	0.0000	0.0000	0.0000	294.6818	528.1666	759.3993 (98a)
Space heating requirement - total per year (kWh/year)												3875.9791
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	743.0086	578.2194	500.1463	308.2256	164.1315	0.0000	0.0000	0.0000	0.0000	294.6818	528.1666	759.3993 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3875.9791
Space heating per m2										(98c) / (4) =		35.1403 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1141.6647	898.7573	921.5483	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7461	0.8095	0.7802	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	851.7678	727.5694	719.0363	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1223.3419	1172.5467	1092.9661	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	267.5333	331.0631	278.2037	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	66.8833	82.7658	69.5509	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												219.2000 (107)
Energy for space heating												35.1403 (99)
Energy for space cooling												1.9873 (108)
Total												37.1276 (109)
Fabric Energy Efficiency (TFEE)												37.1 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING

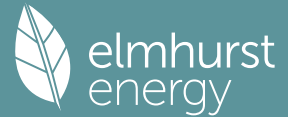
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
First floor	46.3000 (1c)	x 2.3400 (2c)	= 108.3420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.9420 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)

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Number of flueless gas fires

0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
40.0000 / (5) = 0.1527 (8)
Yes
Blower Door
5.0000 (17)
0.4027 (18)
3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3121 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3979	0.3901	0.3823	0.3433	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3511	0.3667 (22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5616	0.5672 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Front Door			2.9000	0.9000	2.6100		(26a)
Windows			10.6000	1.1450	12.1374		(27)
Bi-Fold Doors			4.6000	1.1450	5.2672		(27)
Roof Windows			3.0000	1.2357	3.7072		(27a)
Ground Floor			64.0000	0.1200	7.6800	75.0000	4800.0000 (28a)
Wall (cavity)	99.2000	18.1000	81.1000	0.1800	14.5980	18.0000	1459.8000 (29a)
Wall (dormer)	10.5000		10.5000	0.1700	1.7850	18.0000	189.0000 (29a)
Wall (ashlar)	26.5000		26.5000	0.1700	4.5050	18.0000	477.0000 (29a)
Roof (loft)	22.7000		22.7000	0.1100	2.4970	9.0000	204.3000 (30)
Roof (skeilings)	24.5000	3.0000	21.5000	0.1700	3.6550	9.0000	193.5000 (30)
Roof (void)	17.7000		17.7000	0.1043	1.8455	9.0000	159.3000 (30)
Total net area of external elements Aum(A, m2)			265.1000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 60.2873		(33)
Main dwelling							
Internal Wall			190.0000			9.0000	1710.0000 (32c)
Internal Floor			46.3000			18.0000	833.4000 (32d)
Internal Ceiling			46.3000			9.0000	416.7000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 10443.0000 (34)
List of Thermal Bridges 94.6782 (35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.7000	0.1440	2.1168
E3 Sill	11.1000	0.0480	0.5328
E4 Jamb	28.2000	0.0640	1.8048
E5 Ground floor (normal)	33.4000	0.0510	1.7034
E6 Intermediate floor within a dwelling	31.3000	0.1300	4.0690
E10 Eaves (insulation at ceiling level)	18.8000	0.0750	1.4100
E12 Gable (insulation at ceiling level)	6.0000	0.0620	0.3720
E13 Gable (insulation at rafter level)	7.2000	0.0620	0.4464
E16 Corner (normal)	25.9000	0.0620	1.6058
R1 Head of roof window	3.1000	0.2400	0.7440
R2 Sill of roof window	3.1000	0.2400	0.7440
R3 Jamb of roof window	7.8000	0.2400	1.8720

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.4210 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 77.7083 (37)

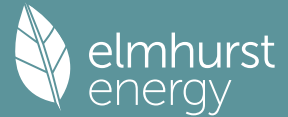
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	50.0641	49.7983	49.5379	48.3144	48.0855	47.0198	47.0198	46.8225	47.4303	48.0855	48.5485	49.0327 (38)
Heat transfer coeff	127.7724	127.5066	127.2462	126.0227	125.7938	124.7281	124.7281	124.5308	125.1386	125.7938	126.2568	126.7410 (39)
Average = Sum(39)m / 12 =												126.0216

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1584	1.1560	1.1536	1.1425	1.1405	1.1308	1.1308	1.1290	1.1345	1.1405	1.1447	1.1491 (40)
HLP (average)												1.1425
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8166 (42)
Hot water usage for mixer showers												
	80.3758	79.1679	77.4078	74.0401	71.5548	68.7833	67.2079	68.9547	70.8695	73.8454	77.2854	80.0679 (42a)
Hot water usage for baths												
	30.8470	30.3889	29.7437	28.5542	27.6635	26.6759	26.1424	26.7831	27.4806	28.5374	29.7514	30.7427 (42b)
Hot water usage for other uses												
	43.4750	41.8940	40.3131	38.7322	37.1513	35.5704	35.5704	37.1513	38.7322	40.3131	41.8940	43.4750 (42c)
Average daily hot water use (litres/day)												142.2265 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	154.6978	151.4508	147.4647	141.3266	136.3697	131.0296	128.9208	132.8891	137.0824	142.6959	148.9308	154.2855 (44)
Energy content (annual)	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											2362.3693 (45)
	36.7505	32.3496	33.9972	29.0203	27.5370	24.1674	23.3878	24.6817	25.3554	29.0455	31.8269	36.2361 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)

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Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739 (64)
	Total per year (kWh/year) = Sum(64)m =										2362.3693 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =										0.0000 (64a)	
Heat gains from water heating, kWh/month	81.4636	71.7083	75.3604	64.3284	61.0403	53.5711	51.8429	54.7110	56.2046	64.3843	70.5496	80.3233 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1401	30.3229	24.6602	18.6694	13.9556	11.7819	12.7307	16.5479	22.2106	28.2014	32.9152	35.0889	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.9498	410.1622	399.5469	376.9481	348.4212	321.6099	303.6983	299.4859	310.1012	332.7000	361.2269	388.0382	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	(71)
Water heating gains (Table 5)	109.4941	106.7087	101.2908	89.3451	82.0434	74.4043	69.6813	73.5363	78.0619	86.5380	97.9856	107.9614	(72)
Total internal gains	663.6326	661.2425	639.5465	599.0112	558.4688	518.8448	497.1590	500.6187	521.4222	561.4880	606.1763	645.1371	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d	Gains W	

North					5.3000	10.6334	0.6300	0.0000				0.7700	27.3388 (74)	
East					1.7000	19.6403	0.6300	0.0000				0.7700	16.1967 (76)	
South					3.6000	46.7521	0.6300	0.0000				0.7700	81.6459 (78)	
South					4.6000	46.7521	0.6300	0.8000				0.7700	75.1143 (78)	
North					1.8000	15.2954	0.6300	0.7000				1.0000	10.9274 (82)	
South					1.2000	47.0123	0.6300	0.7000				1.0000	22.3910 (82)	

Solar gains	233.6141	400.9679	562.3322	728.9585	852.5604	864.0416	825.5533	729.4640	618.8051	446.3064	280.2320	199.7297 (83)		
Total gains	897.2466	1062.2103	1201.8787	1327.9696	1411.0292	1382.8863	1322.7123	1230.0827	1140.2273	1007.7944	886.4083	844.8668 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.7031	22.7504	22.7970	23.0183	23.0602	23.2572	23.2572	23.2941	23.1810	23.0602	22.9757	22.8879
alpha	2.5135	2.5167	2.5198	2.5346	2.5373	2.5505	2.5505	2.5529	2.5454	2.5373	2.5317	2.5259
util living area	0.9310	0.8980	0.8480	0.7647	0.6474	0.5072	0.3880	0.4278	0.6128	0.8034	0.9035	0.9393 (86)
MIT	19.0240	19.3077	19.6972	20.1477	20.5109	20.7404	20.8287	20.8129	20.6425	20.1629	19.5099	18.9649 (87)
Th 2	19.9534	19.9554	19.9573	19.9662	19.9679	19.9758	19.9758	19.9772	19.9727	19.9679	19.9645	19.9610 (88)
util rest of house	0.9218	0.8849	0.8285	0.7344	0.6017	0.4422	0.3064	0.3444	0.5496	0.7709	0.8889	0.9310 (89)
MIT 2	17.6477	18.0025	18.4860	19.0386	19.4609	19.7126	19.7927	19.7830	19.6185	19.0727	18.2693	17.5790 (90)
Living area fraction	fLA = Living area / (4) = 0.1387 (91)											
MIT	17.8386	18.1836	18.6540	19.1924	19.6065	19.8552	19.9364	19.9259	19.7606	19.2239	18.4414	17.7712 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.8386	18.1836	18.6540	19.1924	19.6065	19.8552	19.9364	19.9259	19.7606	19.2239	18.4414	17.7712 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8973	0.8571	0.7993	0.7086	0.5842	0.4340	0.3031	0.3400	0.5353	0.7432	0.8614	0.9080	(94)
Useful gains	805.1374	910.3834	960.6830	940.9862	824.3280	600.2094	400.9547	418.1882	610.3647	748.9853	763.5475	767.1652	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1729.8611	1693.7418	1546.5478	1297.0777	994.5946	655.4664	416.1419	439.0783	708.3564	1084.8306	1431.9278	1720.0302	(97)
Space heating kWh	687.9945	526.4169	435.8834	256.3859	126.6783	0.0000	0.0000	0.0000	0.0000	249.8689	481.2338	708.9316	(98a)
Space heating requirement - total per year (kWh/year)												3473.3932	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	687.9945	526.4169	435.8834	256.3859	126.6783	0.0000	0.0000	0.0000	0.0000	249.8689	481.2338	708.9316	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3473.3932	
Space heating per m2												(98c) / (4) =	31.4904 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Space heating requirement	687.9945	526.4169	435.8834	256.3859	126.6783	0.0000	0.0000	0.0000	0.0000	249.8689	481.2338	708.9316	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	313.7230	240.0442	198.7613	116.9110	57.7649	0.0000	0.0000	0.0000	0.0000	113.9393	219.4409	323.2702	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	128.6783	113.2689	119.0377	101.6119	96.4180	84.6198	81.8900	86.4204	88.7795	101.7001	111.4387	126.8770	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	29.8826	23.9729	21.5850	15.8141	12.2152	9.9800	11.1431	14.4843	18.8137	24.6845	27.8811	30.7131	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1583.8546	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1240.7402	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												241.1696	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3065.7644	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1583.8546	16.4900	261.1776	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1240.7402	16.4900	204.5981	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	241.1696	16.4900	39.7689	(250)
Additional standing charges			0.0000	(251)
Total energy cost			505.5446	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		1.1719	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	81.0035	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1583.8546	0.1551	245.6220	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1240.7402	0.1416	175.6618	(264)
Space and water heating			421.2838	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	241.1696	0.1443	34.8082	(268)
Total CO2, kg/year			456.0920	(272)
CO2 emissions per m2			4.1400	(273)
EI value			96.0646	
EI rating			96	(274)
EI band			A	

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
First floor	46.3000 (1c)	x 2.3400 (2c)	= 108.3420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.9420 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1527 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4027 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121 (21)

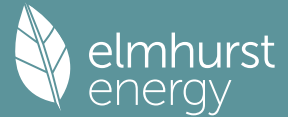
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.3745	0.3511	0.3433	0.3043	0.3043	0.2809	0.2887	0.2731	0.2887	0.3121	0.3199	0.3433 (22b)
Effective ac	0.5701	0.5616	0.5589	0.5463	0.5463	0.5394	0.5417	0.5373	0.5417	0.5487	0.5512	0.5589 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			2.9000	0.9000	2.6100		(26a)
Windows			10.6000	1.1450	12.1374		(27)
Bi-Fold Doors			4.6000	1.1450	5.2672		(27)
Roof Windows			3.0000	1.2357	3.7072		(27a)
Ground Floor			64.0000	0.1200	7.6800	75.0000	4800.0000 (28a)
Wall (cavity)	99.2000	18.1000	81.1000	0.1800	14.5980	18.0000	1459.8000 (29a)
Wall (dormer)	10.5000		10.5000	0.1700	1.7850	18.0000	189.0000 (29a)
Wall (ashlar)	26.5000		26.5000	0.1700	4.5050	18.0000	477.0000 (29a)
Roof (loft)	22.7000		22.7000	0.1100	2.4970	9.0000	204.3000 (30)
Roof (skellings)	24.5000	3.0000	21.5000	0.1700	3.6550	9.0000	193.5000 (30)
Roof (void)	17.7000		17.7000	0.1043	1.8455	9.0000	159.3000 (30)
Total net area of external elements Aum(A, m ²)			265.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.2873		(33)
Main dwelling							
Internal Wall			190.0000			9.0000	1710.0000 (32c)
Internal Floor			46.3000			18.0000	833.4000 (32d)
Internal Ceiling			46.3000			9.0000	416.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10443.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							94.6782 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				14.7000	0.1440	2.1168	
E3 Sill				11.1000	0.0480	0.5328	
E4 Jamb				28.2000	0.0640	1.8048	
E5 Ground floor (normal)				33.4000	0.0510	1.7034	
E6 Intermediate floor within a dwelling				31.3000	0.1300	4.0690	
E10 Eaves (insulation at ceiling level)				18.8000	0.0750	1.4100	
E12 Gable (insulation at ceiling level)				6.0000	0.0620	0.3720	
E13 Gable (insulation at rafter level)				7.2000	0.0620	0.4464	
E16 Corner (normal)				25.9000	0.0620	1.6058	
R1 Head of roof window				3.1000	0.2400	0.7440	
R2 Sill of roof window				3.1000	0.2400	0.7440	
R3 Jamb of roof window				7.8000	0.2400	1.8720	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.4210 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	77.7083 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	49.2826	48.5485	48.3144	47.2224	47.2224	46.6304	46.8225	46.4436	46.8225	47.4303	47.6434	48.3144 (38)
Heat transfer coeff	126.9909	126.2568	126.0227	124.9307	124.9307	124.3387	124.5308	124.1519	124.5308	125.1386	125.3517	126.0227 (39)
Average = Sum(39)m / 12 =												125.2664
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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HLP	1.1513	1.1447	1.1425	1.1326	1.1326	1.1273	1.1290	1.1256	1.1290	1.1345	1.1365	1.1425 (40)
HLP (average)												1.1357
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8166 (42)
Hot water usage for mixer showers												
80.3758	79.1679	77.4078	74.0401	71.5548	68.7833	67.2079	68.9547	70.8695	73.8454	77.2854	80.0679	(42a)
Hot water usage for baths												
30.8470	30.3889	29.7437	28.5542	27.6635	26.6759	26.1424	26.7831	27.4806	28.5374	29.7514	30.7427	(42b)
Hot water usage for other uses												
43.4750	41.8940	40.3131	38.7322	37.1513	35.5704	35.5704	37.1513	38.7322	40.3131	41.8940	43.4750	(42c)
Average daily hot water use (litres/day)												142.2265 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	154.6978	151.4508	147.4647	141.3266	136.3697	131.0296	128.9208	132.8891	137.0824	142.6959	148.9308	154.2855 (44)
Energy conte	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739 (45)
Energy content (annual)										Total = Sum(45)m =		2362.3693
Distribution loss (46)m = 0.15 x (45)m												
36.7505	32.3496	33.9972	29.0203	27.5370	24.1674	23.3878	24.6817	25.3554	29.0455	31.8269	36.2361	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month												
81.4636	71.7083	75.3604	64.3284	61.0403	53.5711	51.8429	54.7110	56.2046	64.3843	70.5496	80.3233	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
34.1401	30.3229	24.6602	18.6694	13.9556	11.7819	12.7307	16.5479	22.2106	28.2014	32.9152	35.0889	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
405.9498	410.1622	399.5469	376.9481	348.4212	321.6099	303.6983	299.4859	310.1012	332.7000	361.2269	388.0382	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	(71)
Water heating gains (Table 5)												
109.4941	106.7087	101.2908	89.3451	82.0434	74.4043	69.6813	73.5363	78.0619	86.5380	97.9856	107.9614	(72)
Total internal gains	663.6326	661.2425	639.5465	599.0112	558.4688	518.8448	497.1590	500.6187	521.4222	561.4880	606.1763	645.1371 (73)

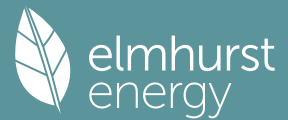
6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		W	
North					5.3000	12.7054	0.6300	0.0000	0.7700		32.6659 (74)	
East					1.7000	23.7288	0.6300	0.0000	0.7700		19.5684 (76)	
South					3.6000	53.5774	0.6300	0.0000	0.7700		93.5653 (78)	
South					4.6000	53.5774	0.6300	0.8000	0.7700		86.0801 (78)	
North					1.8000	18.0509	0.6300	0.7000	1.0000		12.8959 (82)	
South					1.2000	55.2230	0.6300	0.7000	1.0000		26.3016 (82)	
Solar gains	271.0774	414.4972	582.4965	802.7605	908.5454	986.4834	930.7253	826.2629	688.5397	494.2175	328.4764	224.0759 (83)
Total gains	934.7099	1075.7397	1222.0430	1401.7716	1467.0142	1505.3282	1427.8843	1326.8816	1209.9620	1055.7055	934.6526	869.2130 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.8428	22.9757	23.0183	23.2195	23.2195	23.3301	23.2941	23.3652	23.2941	23.1810	23.1416	23.0183
alpha	2.5229	2.5317	2.5346	2.5480	2.5480	2.5553	2.5529	2.5577	2.5529	2.5454	2.5428	2.5346
util living area	0.9186	0.8887	0.8314	0.7269	0.5906	0.4255	0.3026	0.3146	0.5333	0.7520	0.8778	0.9272 (86)
MIT	19.1990	19.4245	19.8226	20.2779	20.6162	20.7997	20.8567	20.8556	20.7332	20.3470	19.7330	19.1770 (87)
Th 2	19.9591	19.9645	19.9662	19.9743	19.9743	19.9786	19.9772	19.9800	19.9772	19.9727	19.9712	19.9662 (88)
util rest of house	0.9075	0.8743	0.8097	0.6930	0.5396	0.3580	0.2209	0.2278	0.4623	0.7109	0.8588	0.9170 (89)
MIT 2	17.8719	18.1550	18.6466	19.1967	19.5805	19.7685	19.8132	19.8160	19.7116	19.2922	18.5509	17.8507 (90)
Living area fraction	fLA = Living area / (4) = 0.1387 (91)											
MIT	18.0560	18.3311	18.8097	19.3467	19.7241	19.9116	19.9580	19.9602	19.8533	19.4385	18.7149	18.0347 (92)
Temperature adjustment	0.0000											

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adjusted MIT 18.0560 18.3311 18.8097 19.3467 19.7241 19.9116 19.9580 19.9602 19.8533 19.4385 18.7149 18.0347 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8815	0.8461	0.7810	0.6699	0.5262	0.3533	0.2193	0.2260	0.4531	0.6863	0.8302	0.8921	(94)
Useful gains	823.9657	910.1943	954.3841	938.9805	772.0001	531.8461	313.1444	299.9183	548.1953	724.5464	775.9575	775.4525	(95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Heat loss rate W	1657.9929	1632.6441	1475.6909	1230.1551	890.0234	560.9646	318.5438	305.4402	604.3822	968.3876	1330.5951	1617.4609	(97)
Space heating kWh	620.5162	485.4863	387.8523	209.6457	87.8093	0.0000	0.0000	0.0000	0.0000	181.4179	399.3391	626.4542	(98a)
Space heating requirement - total per year (kWh/year)												2998.5210	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	620.5162	485.4863	387.8523	209.6457	87.8093	0.0000	0.0000	0.0000	0.0000	181.4179	399.3391	626.4542	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2998.5210	
Space heating per m2										(98c) / (4) =		27.1851	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													219.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	620.5162	485.4863	387.8523	209.6457	87.8093	0.0000	0.0000	0.0000	0.0000	181.4179	399.3391	626.4542	(98)	
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)	
Space heating fuel (main heating system)	282.9531	221.3800	176.8592	95.5977	40.0407	0.0000	0.0000	0.0000	0.0000	82.7259	182.0972	285.6608	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739	(64)	
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)	
Fuel for water heating, kWh/month	128.6783	113.2689	119.0377	101.6119	96.4180	84.6198	81.8900	86.4204	88.7795	101.7001	111.4387	126.8770	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	29.8826	23.9729	21.5850	15.8141	12.2152	9.9800	11.1431	14.4843	18.8137	24.6845	27.8811	30.7131	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												1367.3146	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												190.4000		
Water heating fuel used												1240.7402	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
Total electricity for the above, kWh/year												0.0000	(231)	
Electricity for lighting (calculated in Appendix L)												241.1696	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												0.0000	(233)	
Wind generation												0.0000	(234)	
Hydro-electric generation (Appendix N)												0.0000	(235a)	
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)	
Appendix Q - special features														
Energy saved or generated												-0.0000	(236)	
Energy used												0.0000	(237)	
Total delivered energy for all uses												2849.2244	(238)	

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1367.3146	26.0600	356.3222	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1240.7402	26.0600	323.3369	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	241.1696	26.0600	62.8488	(250)

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Additional standing charges 0.0000 (251)
Total energy cost 742.5079 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1367.3146	0.1557	212.8676 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1240.7402	0.1416	175.6618 (264)
Space and water heating			388.5293 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	241.1696	0.1443	34.8082 (268)
Total CO2, kg/year			423.3376 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1367.3146	1.5764	2155.3966 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1240.7402	1.5235	1890.3154 (278)
Space and water heating			4045.7120 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	241.1696	1.5338	369.9140 (282)
Total Primary energy kWh/year			4415.6260 (286)

SAP 10 EPC IMPROVEMENTS

DB0101

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 76	-36 kg (8.6%)
U Solar photovoltaic panels	+ 7.3	-£ 303	-248 kg (64.0%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£76	0.33 kg/m²	B 82 A 96
Solar photovoltaic panels	£303	2.25 kg/m²	B 90 A 98
Total Savings	£379	2.57 kg/m²	
Potential energy efficiency rating:		B 90	
Potential environmental impact rating:			A 98

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

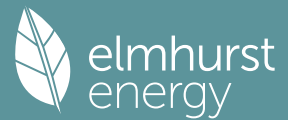
	Current	Potential	Saving
Electricity	£743	£667	£76
Space heating	£356	£377	-£21
Water heating	£323	£227	£96
Lighting	£63	£63	£0
Generated (PV)	-£0	-£303	£303
Total cost of fuels	£743	£364	£379
Total cost of uses	£742	£364	£378
Delivered energy	26 kWh/m²	6 kWh/m²	20 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.1 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	1 kg/m²	3 kg/m²
Primary energy	40 kWh/m²	19 kWh/m²	21 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Main dwelling			
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
First floor	46.3000 (1c)	x 2.3400 (2c)	= 108.3420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.9420 (5)

Full SAP Calculation Printout



2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												40.0000 / (5) =	0.1527 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.4027 (18)	
Number of sides sheltered												3 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.7750 (20)	
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3121 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3979	0.3901	0.3823	0.3433	0.3355	0.2965	0.2965	0.2887	0.3121	0.3355	0.3511	0.3667	(22b)
Effective ac	0.5792	0.5761	0.5731	0.5589	0.5563	0.5440	0.5440	0.5417	0.5487	0.5563	0.5616	0.5672	(25)

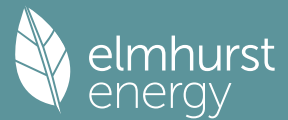
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.9000	0.9000	2.6100			(26a)
Windows			10.6000	1.1450	12.1374			(27)
Bi-Fold Doors			4.6000	1.1450	5.2672			(27)
Roof Windows			3.0000	1.2357	3.7072			(27a)
Ground Floor			64.0000	0.1200	7.6800	75.0000	4800.0000	(28a)
Wall (cavity)	99.2000	18.1000	81.1000	0.1800	14.5980	18.0000	1459.8000	(29a)
Wall (dormer)	10.5000		10.5000	0.1700	1.7850	18.0000	189.0000	(29a)
Wall (ashlar)	26.5000		26.5000	0.1700	4.5050	18.0000	477.0000	(29a)
Roof (loft)	22.7000		22.7000	0.1100	2.4970	9.0000	204.3000	(30)
Roof (skeilings)	24.5000	3.0000	21.5000	0.1700	3.6550	9.0000	193.5000	(30)
Roof (void)	17.7000		17.7000	0.1043	1.8455	9.0000	159.3000	(30)
Total net area of external elements Aum(A, m2)			265.1000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 60.2873			(33)
Main dwelling								
Internal Wall			190.0000			9.0000	1710.0000	(32c)
Internal Floor			46.3000			18.0000	833.4000	(32d)
Internal Ceiling			46.3000			9.0000	416.7000	(32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10443.0000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							94.6782	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				14.7000	0.1440	2.1168		
E3 Sill				11.1000	0.0480	0.5328		
E4 Jamb				28.2000	0.0640	1.8048		
E5 Ground floor (normal)				33.4000	0.0510	1.7034		
E6 Intermediate floor within a dwelling				31.3000	0.1300	4.0690		
E10 Eaves (insulation at ceiling level)				18.8000	0.0750	1.4100		
E12 Gable (insulation at ceiling level)				6.0000	0.0620	0.3720		
E13 Gable (insulation at rafter level)				7.2000	0.0620	0.4464		
E16 Corner (normal)				25.9000	0.0620	1.6058		
R1 Head of roof window				3.1000	0.2400	0.7440		
R2 Sill of roof window				3.1000	0.2400	0.7440		
R3 Jamb of roof window				7.8000	0.2400	1.8720		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.4210	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	77.7083	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8166 (42)											
Hot water usage for mixer showers	80.3758 79.1679 77.4078 74.0401 71.5548 68.7833 67.2079 68.9547 70.8695 73.8454 77.2854 80.0679 (42a)											
Hot water usage for baths	30.8470 30.3889 29.7437 28.5542 27.6635 26.6759 26.1424 26.7831 27.4806 28.5374 29.7514 30.7427 (42b)											
Hot water usage for other uses	43.4750 41.8940 40.3131 38.7322 37.1513 35.5704 35.5704 37.1513 38.7322 40.3131 41.8940 43.4750 (42c)											
Average daily hot water use (litres/day)	142.2265 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	154.6978	151.4508	147.4647	141.3266	136.3697	131.0296	128.9208	132.8891	137.0824	142.6959	148.9308	154.2855 (44)

Full SAP Calculation Printout



Energy content (annual)	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2362.3693
Water storage loss:												
Total storage loss	36.7505	32.3496	33.9972	29.0203	27.5370	24.1674	23.3878	24.6817	25.3554	29.0455	31.8269	36.2361 (46)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS	245.0034	215.6640	226.6477	193.4690	183.5798	161.1162	155.9185	164.5445	169.0362	193.6370	212.1793	241.5739 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Aperture area of solar collector	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Zero-loss collector efficiency												3.0000 (H1)
Collector linear heat loss coefficient												0.8000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector loop efficiency												0.0000 (H4)
Incidence angle modifier												0.9000 (H5)
Overshading factor												1.0000 (H6)
Overall heat loss coefficient of system												0.8000 (H8)
Heat loss coefficient of collector loop												6.5000 (H10)
Dedicated solar storage volume												3.9667 (H11)
Effective solar volume												75.0000 (H12)
Reference volume												75.0000 (H14)
Storage tank correction coefficient												225.0000 (H15)
Heat delivered to hot water												1.3161 (H16)
Heat delivered to space heating												603.7998 (H24)
Solar input												0.0000 (H29)
Solar input	-0.0000	-16.2347	-57.5195	-78.3169	-101.5829	-92.8524	-91.5691	-80.9012	-56.3043	-28.5186	-0.0000	603.7998
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Electric shower(s)	245.0034	199.4293	169.1282	115.1521	81.9969	68.2637	64.3493	83.6432	112.7319	165.1183	212.1793	241.5739 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												1758.5695 (64)
Heat gains from water heating, kWh/month												
	81.4636	71.7083	75.3604	64.3284	61.0403	53.5711	51.8429	54.7110	56.2046	64.3843	70.5496	80.3233 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1401	30.3229	24.6602	18.6694	13.9556	11.7819	12.7307	16.5479	22.2106	28.2014	32.9152	35.0889 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.9498	410.1622	399.5469	376.9481	348.4212	321.6099	303.6983	299.4859	310.1012	332.7000	361.2269	388.0382 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646 (71)
Water heating gains (Table 5)	109.4941	106.7087	101.2908	89.3451	82.0434	74.4043	69.6813	73.5363	78.0619	86.5380	97.9856	107.9614 (72)
Total internal gains	663.6326	661.2425	639.5465	599.0112	558.4688	518.8448	497.1590	500.6187	521.4222	561.4880	606.1763	645.1371 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d	Gains W	

North					5.3000	10.6334	0.6300	0.0000				0.7700	27.3388 (74)	
East					1.7000	19.6403	0.6300	0.0000				0.7700	16.1967 (76)	
South					3.6000	46.7521	0.6300	0.0000				0.7700	81.6459 (78)	
South					4.6000	46.7521	0.6300	0.8000				0.7700	75.1143 (78)	
North					1.8000	15.2954	0.6300	0.7000				1.0000	10.9274 (82)	
South					1.2000	47.0123	0.6300	0.7000				1.0000	22.3910 (82)	

Solar gains	233.6141	400.9679	562.3322	728.9585	852.5604	864.0416	825.5533	729.4640	618.8051	446.3064	280.2320	199.7297 (83)		
Total gains	897.2466	1062.2103	1201.8787	1327.9696	1411.0292	1382.8863	1322.7123	1230.0827	1140.2273	1007.7944	886.4083	844.8668 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.7031	22.7504	22.7970	23.0183	23.0602	23.2572	23.2572	23.2941	23.1810	23.0602	22.9757	22.8879
alpha	2.5135	2.5167	2.5198	2.5346	2.5373	2.5505	2.5505	2.5529	2.5454	2.5373	2.5317	2.5259
util living area	0.9310	0.8980	0.8480	0.7647	0.6474	0.5072	0.3880	0.4278	0.6128	0.8034	0.9035	0.9393 (86)
MIT	19.0240	19.3077	19.6972	20.1477	20.5109	20.7404	20.8287	20.8129	20.6425	20.1629	19.5099	18.9649 (87)
Th 2	19.9534	19.9554	19.9573	19.9662	19.9679	19.9758	19.9758	19.9772	19.9727	19.9679	19.9645	19.9610 (88)
util rest of house	0.9218	0.8849	0.8285	0.7344	0.6017	0.4422	0.3064	0.3444	0.5496	0.7709	0.8889	0.9310 (89)
MIT 2	17.6477	18.0025	18.4860	19.0386	19.4609	19.7126	19.7927	19.7830	19.6185	19.0727	18.2693	17.5790 (90)
Living area fraction									fLA = Living area / (4) =			0.1387 (91)
MIT	17.8386	18.1836	18.6540	19.1924	19.6065	19.8552	19.9364	19.9259	19.7606	19.2239	18.4414	17.7712 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8386	18.1836	18.6540	19.1924	19.6065	19.8552	19.9364	19.9259	19.7606	19.2239	18.4414	17.7712 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8973	0.8571	0.7993	0.7086	0.5842	0.4340	0.3031	0.3400	0.5353	0.7432	0.8614	0.9080	(94)
Useful gains	805.1374	910.3834	960.6830	940.9862	824.3280	600.2094	400.9547	418.1882	610.3647	748.9853	763.5475	767.1652	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1729.8611	1693.7418	1546.5478	1297.0777	994.5946	655.4664	416.1419	439.0783	708.3564	1084.8306	1431.9278	1720.0302	(97)
Space heating kWh	687.9945	526.4169	435.8834	256.3859	126.6783	0.0000	0.0000	0.0000	0.0000	249.8689	481.2338	708.9316	(98a)
Space heating requirement - total per year (kWh/year)												3473.3932	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	687.9945	526.4169	435.8834	256.3859	126.6783	0.0000	0.0000	0.0000	0.0000	249.8689	481.2338	708.9316	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3473.3932	
Space heating per m2											(98c) / (4) =	31.4904	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												219.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	687.9945	526.4169	435.8834	256.3859	126.6783	0.0000	0.0000	0.0000	0.0000	249.8689	481.2338	708.9316	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	313.7230	240.0442	198.7613	116.9110	57.7649	0.0000	0.0000	0.0000	0.0000	113.9393	219.4409	323.2702	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	245.0034	199.4293	169.1282	115.1521	81.9969	68.2637	64.3493	83.6432	112.7319	165.1183	212.1793	241.5739	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	128.6783	104.7423	88.8278	60.4790	43.0656	35.8528	33.7969	43.9303	59.2079	86.7218	111.4387	126.8770	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	29.8826	23.9729	21.5850	15.8141	12.2152	9.9800	11.1431	14.4843	18.8137	24.6845	27.8811	30.7131	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-39.0317	-58.5833	-88.1084	-101.1001	-107.3468	-94.4487	-92.9560	-87.5074	-77.2146	-66.9289	-43.8320	-33.3561	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-11.0548	-24.9966	-54.2378	-89.6719	-128.3359	-137.2650	-135.6955	-112.2665	-79.2485	-39.9170	-15.5778	-8.5577	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1583.8546	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												923.6184	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												241.1696	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1101.4033	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1583.8546	16.4900	261.1776	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	923.6184	16.4900	152.3047	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	16.4900	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	241.1696	16.4900	39.7689	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-890.4141	16.4900	-146.8293	

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PV Unit electricity exported	-836.8253	5.5900	-46.7785
Total			-193.6078 (252)
Total energy cost			272.8354 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.6325 (257)
SAP value		89.7479
SAP rating (Section 12)		90 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1583.8546	0.1551	245.6220 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	923.6184	0.1463	135.1569 (264)
Space and water heating			380.7788 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	241.1696	0.1443	34.8082 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-890.4141	0.1346	-119.8742
PV Unit electricity exported	-836.8253	0.1227	-102.7021
Total			-222.5763 (269)
Total CO2, kg/year			204.1077 (272)
CO2 emissions per m2			1.8500 (273)
EI value			98.2389
EI rating			98 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	64.0000 (1b)	x 2.4000 (2b)	= 153.6000 (1b) - (3b)
First floor	46.3000 (1c)	x 2.3400 (2c)	= 108.3420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.9420 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1527 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4027 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3121 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.3745	0.3511	0.3433	0.3043	0.3043	0.2809	0.2887	0.2731	0.2887	0.3121	0.3199	0.3433 (22b)
Effective ac	0.5701	0.5616	0.5589	0.5463	0.5463	0.5394	0.5417	0.5373	0.5417	0.5487	0.5512	0.5589 (25)

3. Heat losses and heat loss parameter

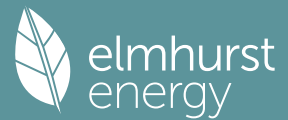
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Front Door			2.9000	0.9000	2.6100		(26a)
Windows			10.6000	1.1450	12.1374		(27)
Bi-Fold Doors			4.6000	1.1450	5.2672		(27)

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energy

Ventilation heat loss calculated month ¹ (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 49.2826	Feb 48.5485	Mar 48.3144	Apr 47.2224	May 47.2224	Jun 46.6304	Jul 46.8225	Aug 46.4436	Sep 46.8225	Oct 47.4303	Nov 47.6434	Dec 48.3144 (38)
Heat transfer coeff	126.9909	126.2568	126.0227	124.9307	124.9307	124.3387	124.5308	124.1519	124.5308	125.1386	125.3517	126.0227 (39)
Average = Sum(39)m / 12 =												125.2664
HLP	Jan 1.1513	Feb 1.1447	Mar 1.1425	Apr 1.1326	May 1.1326	Jun 1.1273	Jul 1.1290	Aug 1.1256	Sep 1.1290	Oct 1.1345	Nov 1.1365	Dec 1.1425 (40)
HLP (average)												1.1357
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	168.9969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1401	30.3229	24.6602	18.6694	13.9556	11.7819	12.7307	16.5479	22.2106	28.2014	32.9152	35.0889	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.9498	410.1622	399.5469	376.9481	348.4212	321.6099	303.6983	299.4859	310.1012	332.7000	361.2269	388.0382	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	54.7163	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	-112.6646	(71)
Water heating gains (Table 5)	109.4941	106.7087	101.2908	89.3451	82.0434	74.4043	69.6813	73.5363	78.0619	86.5380	97.9856	107.9614	(72)
Total internal gains	663.6326	661.2425	639.5465	599.0112	558.4688	518.8448	497.1590	500.6187	521.4222	561.4880	606.1763	645.1371	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				5.3000	12.7054		0.6300		0.0000		0.7700		32.6659 (74)
East				1.7000	23.7288		0.6300		0.0000		0.7700		19.5684 (76)
South				3.6000	53.5774		0.6300		0.0000		0.7700		93.5653 (78)
South				4.6000	53.5774		0.6300		0.8000		0.7700		86.0801 (78)
North				1.8000	18.0509		0.6300		0.7000		1.0000		12.8959 (82)
South				1.2000	55.2230		0.6300		0.7000		1.0000		26.3016 (82)
Solar gains	271.0774	414.4972	582.4965	802.7605	908.5454	986.4834	930.7253	826.2629	688.5397	494.2175	328.4764	224.0759	(83)
Total gains	934.7099	1075.7397	1222.0430	1401.7716	1467.0142	1505.3282	1427.8843	1326.8816	1209.9620	1055.7055	934.6526	869.2130	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
tau	22.8428	22.9757	23.0183	23.2195	23.2195	23.3301	23.2941	23.3652	23.2941	23.1810	23.1416	23.0183		
alpha	2.5229	2.5317	2.5346	2.5480	2.5480	2.5553	2.5529	2.5577	2.5529	2.5454	2.5428	2.5346		
util living area	0.9186	0.8887	0.8314	0.7269	0.5906	0.4255	0.3026	0.3146	0.5333	0.7520	0.8778	0.9272	(86)	
MIT	19.1990	19.4245	19.8226	20.2779	20.6162	20.7997	20.8567	20.8556	20.7332	20.3470	19.7330	19.1770	(87)	
Th 2	19.9591	19.9645	19.9662	19.9743	19.9743	19.9786	19.9772	19.9800	19.9772	19.9727	19.9712	19.9662	(88)	
util rest of house	0.9075	0.8743	0.8097	0.6930	0.5396	0.3580	0.2209	0.2278	0.4623	0.7109	0.8588	0.9170	(89)	
MIT 2	17.8719	18.1550	18.6466	19.1967	19.5805	19.7685	19.8132	19.8160	19.7116	19.2922	18.5509	17.8507	(90)	
Living area fraction									fLA = Living area / (4) =			0.1387	(91)	
MIT	18.0560	18.3311	18.8097	19.3467	19.7241	19.9116	19.9580	19.9602	19.8533	19.4385	18.7149	18.0347	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.0560	18.3311	18.8097	19.3467	19.7241	19.9116	19.9580	19.9602	19.8533	19.4385	18.7149	18.0347	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	823.9657	910.1943	954.3841	938.9805	772.0001	531.8461	313.1444	299.9183	548.1953	724.5464	775.9575	775.4525	(94)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Heat loss rate W	1657.9929	1632.6441	1475.6909	1230.1551	890.0234	560.9646	318.5438	305.4402	604.3822	968.3876	1330.5951	1617.4609	(97)
Space heating kWh	620.5162	485.4863	387.8523	209.6457	87.8093	0.0000	0.0000	0.0000	0.0000	181.4179	399.3391	626.4542	(98a)
Space heating requirement - total per year (kWh/year)												2998.5210	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	620.5162	485.4863	387.8523	209.6457	87.8093	0.0000	0.0000	0.0000	0.0000	181.4179	399.3391	626.4542	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2998.5210	
Space heating per m2										(98c) / (4) =		27.1851	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												219.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	620.5162	485.4863	387.8523	209.6457	87.8093	0.0000	0.0000	0.0000	0.0000	181.4179	399.3391	626.4542	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	282.9531	221.3800	176.8592	95.5977	40.0407	0.0000	0.0000	0.0000	0.0000	82.7259	182.0972	285.6608	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	244.2734	195.7899	163.5102	103.3951	73.5149	53.7875	51.3537	69.3143	100.9716	154.7418	205.3409	241.5739	(64)

13a. Primary energy - Individual heating systems including micro-CHP			
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1367.3146	1.5764	2155.3966 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	870.5711	1.5453	1345.2822 (278)
Space and water heating			3500.6788 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	241.1696	1.5338	369.9140 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-945.2507	1.4982	-1416.1501
PV Unit electricity exported	-982.3596	0.4492	-441.3081
Total			-1857.4582 (283)
Total Primary energy kWh/year			2134.1587 (286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 07 Apr 2025 15:03:07

Project Information			
Assessed By	Joe Solti	Building Type	House, Detached
OCDEA Registration	EES/003578	Assessment Date	2025-04-07

Dwelling Details			
Assessment Type	As designed	Total Floor Area	109 m ²
Site Reference	DB0102	Plot Reference	DB0102
Address	R/O Karenza Plot 2 Hook Lane, Aldingbourne		

Client Details	
Name	.
Company	.
Address	., ., .

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	10.49 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	4.18 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	54.68 kWh _{PE} /m ²		
Dwelling primary energy	43.49 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	39.9 kWh/m ²		
Dwelling fabric energy efficiency	37.5 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.12	Exposed Floor (0.2)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.18	Windows (N) (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	131.95	0.18	
Ground floor: Ground Floor, Ground Floor	53.2	0.12	
Upper floor: Exposed Floor, Exposed Floor	2.35	0.2	
Exposed roof: Roof (1)	53.2	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front Door, Front Door	2.1	North	N/A	0.9 (!)
Windows (N), Windows	8.3	North	1.0	1.2
Windows (S), Windows	4.7	South	1.0	1.2
Windows (E), Windows	0.7	East	1.0	1.2
French Doors, French Doors	11.35	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.144	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.048	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.064	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.051	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.13	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.062	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.062	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.062	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
External wall	E20: Exposed floor (normal)	SAP table default	0.32	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	219.3%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

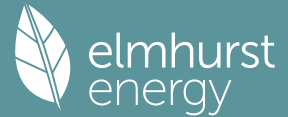
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

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Property Reference	DB0102				Issued on Date	07/04/2025
Assessment Reference	DB0102	Prop Type Ref		New Dwelling		
Property	Plot 2, R/O Karenza, Hook Lane, Aldingbourne, West Sussex					
SAP Rating	81 B	DER	4.18	TER	10.49	
Environmental	96 A	% DER < TER				60.15
CO ₂ Emissions (t/year)	0.41	DFEE	37.54	TFEE	39.88	
Compliance Check	See BREL	% DFEE < TFEE				5.89
% DPER < TPER	20.47	DPER	43.49	TPER	54.68	
Assessor Details	Mr. Joe Solti				Assessor ID	5122-0001
Client	SBC Limited, .					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	53.2000 (1b)	x 2.4000 (2b)	= 127.6800 (1b) - (3b)
First floor	55.5000 (1c)	x 2.6900 (2c)	= 149.2950 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 276.9750 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1444 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3944 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3057 (21)

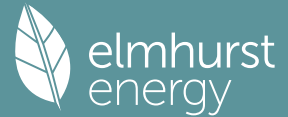
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3897	0.3821	0.3744	0.3362	0.3286	0.2904	0.2904	0.2827	0.3057	0.3286	0.3439	0.3592 (22b)
Effective ac	0.5759	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			13.7000	1.1450	15.6870		(27)
French Doors			11.3500	1.1450	12.9962		(27)
Ground Floor			53.2000	0.1200	6.3840	75.0000	3990.0000 (28a)
Exposed Floor			2.3500	0.2000	0.4700	20.0000	47.0000 (28b)
Wall (cavity)	159.1000	27.1500	131.9500	0.1800	23.7510	18.0000	2375.1000 (29a)
Roof (loft)	53.2000		53.2000	0.1100	5.8520	9.0000	478.8000 (30)
Total net area of external elements Aum(A, m ²)			267.8500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.0302		(33)
Main dwelling							
Internal Wall			180.0000			9.0000	1620.0000 (32c)
Internal Floor			53.2000			18.0000	957.6000 (32d)
Internal Ceiling			53.2000			9.0000	478.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9947.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							91.5115 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				21.9000	0.1440	3.1536	

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Total gains 996.5261 1288.6429 1490.5009 1661.1269 1751.0371 1715.6049 1651.4557 1560.8270 1474.9547 1267.3499 1038.9824 925.3201 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.2755	20.3157	20.3553	20.5431	20.5786	20.7456	20.7456	20.7768	20.6810	20.5786	20.5069	20.4324	21.0000 (85)
alpha	2.3517	2.3544	2.3570	2.3695	2.3719	2.3830	2.3830	2.3851	2.3787	2.3719	2.3671	2.3622	
util living area	0.9140	0.8579	0.7923	0.6960	0.5783	0.4448	0.3349	0.3653	0.5287	0.7367	0.8720	0.9253	(86)
MIT	18.9201	19.3200	19.7436	20.1939	20.5316	20.7429	20.8242	20.8119	20.6669	20.2059	19.4828	18.8414	(87)
Th 2	19.8773	19.8792	19.8812	19.8902	19.8919	19.8998	19.8998	19.9013	19.8968	19.8919	19.8885	19.8849	(88)
util rest of house	0.9027	0.8407	0.7679	0.6612	0.5302	0.3808	0.2577	0.2864	0.4643	0.6979	0.8534	0.9154	(89)
MIT 2	17.4681	17.9627	18.4813	19.0245	19.4102	19.6379	19.7096	19.7026	19.5663	19.0566	18.1820	17.3754	(90)
Living area fraction	17.7420	18.2187	18.7194	19.2451	19.6217	19.8463	19.9198	19.9118	19.7739	19.2734	18.4273	17.6519	(91)
MIT	17.7420	18.2187	18.7194	19.2451	19.6217	19.8463	19.9198	19.9118	19.7739	19.2734	18.4273	17.6519	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7420	18.2187	18.7194	19.2451	19.6217	19.8463	19.9198	19.9118	19.7739	19.2734	18.4273	17.6519	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8748	0.8099	0.7387	0.6388	0.5176	0.3775	0.2592	0.2872	0.4566	0.6732	0.8231	0.8890	(94)
Useful gains	871.7546	1043.6516	1100.9865	1061.1708	906.3795	647.6043	427.9964	448.3122	673.5090	853.1306	855.1546	822.6541	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1831.8634	1811.4684	1658.7250	1391.4581	1063.6695	698.7584	442.1726	467.0407	758.0752	1164.5955	1526.2646	1819.1438	(97)
Space heating kWh	714.3210	515.9729	414.9574	237.8068	117.0238	0.0000	0.0000	0.0000	0.0000	231.7299	483.1992	741.3883	(98a)
Space heating requirement - total per year (kWh/year)												3456.3993	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	714.3210	515.9729	414.9574	237.8068	117.0238	0.0000	0.0000	0.0000	0.0000	231.7299	483.1992	741.3883	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3456.3993	
Space heating per m2										(98c) / (4) =		31.7976	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)

Fraction of space heat from main system(s)

Efficiency of main space heating system 1 (in %)

Efficiency of main space heating system 2 (in %)

Efficiency of secondary/supplementary heating system, %

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	714.3210	515.9729	414.9574	237.8068	117.0238	0.0000	0.0000	0.0000	0.0000	231.7299	483.1992	741.3883	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	325.7278	235.2818	189.2191	108.4390	53.3624	0.0000	0.0000	0.0000	0.0000	105.6680	220.3371	338.0704	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	128.3816	113.0078	118.7632	101.3776	96.1957	84.4248	81.7012	86.2212	88.5749	101.4656	111.1818	126.5845	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	28.9170	23.1983	20.8875	15.3030	11.8205	9.6575	10.7831	14.0162	18.2057	23.8869	26.9802	29.7207	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1576.1055	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1237.8797	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												233.3764	(232)

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3047.3616 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1576.1055	0.1554	244.9871	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1237.8797	0.1416	175.2568	(264)
Space and water heating			420.2439	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	233.3764	0.1443	33.6834	(268)
Total CO2, kg/year			453.9273	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1576.1055	1.5754	2483.0515	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1237.8797	1.5235	1885.9574	(278)
Space and water heating			4369.0089	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	233.3764	1.5338	357.9606	(282)
Total Primary energy kWh/year			4726.9695	(286)
Dwelling Primary energy Rate (DPER)			43.4900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	53.2000 (1b)	x 2.4000 (2b)	= 127.6800	(1b) - (3b)
First floor	55.5000 (1c)	x 2.6900 (2c)	= 149.2950	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.7000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 276.9750	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

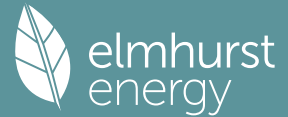
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1444 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3944	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3057 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3897	0.3821	0.3744	0.3362	0.3286	0.2904	0.2904	0.2827	0.3057	0.3286	0.3439	0.3592	(22b)
Effective ac	0.5759	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			2.1000	1.0000	2.1000			(26a)

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TER Opening Type			25.0500	1.1450	28.6832	(27)
Ground Floor			53.2000	0.1300	6.9160	(28a)
Exposed Floor			2.3500	0.1300	0.3055	(28b)
Wall (cavity)	159.1000	27.1500	131.9500	0.1800	23.7510	(29a)
Roof (loft)	53.2000		53.2000	0.1100	5.8520	(30)
Total net area of external elements Aum(A, m2)			267.8500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	67.6077		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 91.5115 (35)

List of Thermal Bridges						
K1 Element			Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)			21.9000	0.0500	1.0950	
E3 Sill			15.5000	0.0500	0.7750	
E4 Jamb			35.9000	0.0500	1.7950	
E5 Ground floor (normal)			30.4000	0.1600	4.8640	
E6 Intermediate floor within a dwelling			27.8000	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)			18.7000	0.0600	1.1220	
E12 Gable (insulation at ceiling level)			13.5000	0.0600	0.8100	
E13 Gable (insulation at rafter level)			0.1000	0.0800	0.0080	
E16 Corner (normal)			25.7000	0.0900	2.3130	
R1 Head of roof window			0.0000	0.0800	0.0000	
R2 Sill of roof window			0.0000	0.0600	0.0000	
R3 Jamb of roof window			0.0000	0.0800	0.0000	
E20 Exposed floor (normal)			4.4000	0.3200	1.4080	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.1900 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 81.7977 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	52.6425	52.3729	52.1087	50.8677	50.6355	49.5547	49.5547	49.3545	49.9710	50.6355	51.1052	51.5963	(38)
Average = Sum(39)m / 12 =	134.4402	134.1706	133.9064	132.6654	132.4332	131.3524	131.3524	131.1522	131.7687	132.4332	132.9030	133.3940	(39)
												132.6643	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2368	1.2343	1.2319	1.2205	1.2183	1.2084	1.2084	1.2066	1.2122	1.2183	1.2227	1.2272	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

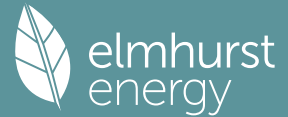
Assumed occupancy													2.8068 (42)
Hot water usage for mixer showers													
	71.2805	70.2093	68.6483	65.6617	63.4577	60.9997	59.6027	61.1518	62.8500	65.4890	68.5398	71.0074	(42a)
Hot water usage for baths													
	30.7762	30.3191	29.6755	28.4887	27.6000	26.6147	26.0824	26.7216	27.4175	28.4719	29.6831	30.6721	(42b)
Hot water usage for other uses													
	43.3744	41.7971	40.2199	38.6426	37.0654	35.4881	35.4881	37.0654	38.6426	40.2199	41.7971	43.3744	(42c)
Average daily hot water use (litres/day)													133.6838 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	145.4310	142.3255	138.5437	132.7930	128.1231	123.1025	121.1732	124.9388	128.9101	134.1808	140.0200	145.0539	(44)
Energy conte	230.3272	202.6696	212.9364	181.7870	172.4783	151.3689	146.5485	154.7003	158.9590	182.0820	199.4841	227.1194	(45)
Energy content (annual)													Total = Sum(45)m = 2220.4609
Distribution loss (46)m = 0.15 x (45)m													
	34.5491	30.4004	31.9405	27.2681	25.8717	22.7053	21.9823	23.2050	23.8439	27.3123	29.9226	34.0679	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.3938 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7527 (55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	276.9221	244.7554	259.5314	226.8789	219.0732	196.4608	193.1434	201.2952	204.0508	228.6769	244.5760	273.7143	(62)
WWHRS	-32.5865	-28.8197	-30.1784	-24.9889	-23.2887	-19.9283	-18.6796	-19.8639	-20.6186	-24.3071	-27.5370	-31.9830	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	244.3357	215.9356	229.3530	201.8900	195.7845	176.5324	174.4638	181.4312	183.4322	204.3698	217.0390	241.7312	(64)
												2466.2984	(64)
12Total per year (kWh/year)												2466	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													
Heat gains from water heating, kWh/month													
	113.8597	101.0562	108.0773	96.5177	94.6250	86.4036	86.0033	88.7138	88.9273	97.8182	102.4020	112.7931	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.0200	150.5936	136.0200	140.5540	136.0200	140.5540	136.0200	136.0200	140.5540	136.0200	140.5540	136.0200	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	269.6749	272.4733	265.4214	250.4089	231.4583	213.6474	201.7486	198.9503	206.0021	221.0146	239.9652	257.7761	(68)
Pumps, fans	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	(71)
Water heating gains (Table 5)													
	153.0373	150.3813	145.2652	134.0523	127.1841	120.0051	115.5958	119.2389	123.5102	131.4761	142.2249	151.6036	(72)
Total internal gains	626.8340	641.5500	614.8085	593.1171	562.7643	539.3084	518.4664	519.3111	535.1682	556.6126	590.8461	613.5016	(73)

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6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	8.3000		10.6334		0.6300		0.7000		0.7700		26.9725	(74)
East	0.7000		19.6403		0.6300		0.7000		0.7700		4.2016	(76)
South	16.0500		46.7521		0.6300		0.7000		0.7700		229.3230	(78)
Solar gains	260.4972	435.3372	579.5372	701.1415	777.1696	769.9033	742.8106	685.0544	620.8113	476.2012	310.3390	224.0970 (83)
Total gains	887.3312	1076.8872	1194.3457	1294.2586	1339.9339	1309.2117	1261.2770	1204.3655	1155.9795	1032.8138	901.1851	837.5987 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.5529	20.5942	20.6348	20.8279	20.8644	21.0361	21.0361	21.0682	20.9696	20.8644	20.7907	20.7141
alpha	2.3702	2.3729	2.3757	2.3885	2.3910	2.4024	2.4024	2.4045	2.3980	2.3910	2.3860	2.3809
util living area	0.9299	0.8937	0.8495	0.7764	0.6748	0.5403	0.4173	0.4485	0.6173	0.7983	0.8987	0.9376 (86)
MIT	18.2790	18.7029	19.2204	19.8427	20.3685	20.7419	20.9000	20.8777	20.6218	19.9338	19.0020	18.2011 (87)
Th 2	19.8907	19.8926	19.8946	19.9037	19.9054	19.9133	19.9133	19.9148	19.9102	19.9054	19.9019	19.8983 (88)
util rest of house	0.9204	0.8799	0.8297	0.7460	0.6283	0.4708	0.3270	0.3584	0.5518	0.7645	0.8832	0.9291 (89)
MIT 2	16.7451	17.2741	17.9174	18.6812	19.2996	19.7109	19.8568	19.8417	19.5933	18.8094	17.6642	16.6517 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.0344	17.5436	18.1631	18.9003	19.5012	19.9054	20.0536	20.0371	19.7873	19.0215	17.9165	16.9439 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.0344	17.5436	18.1631	18.9003	19.5012	19.9054	20.0536	20.0371	19.7873	19.0215	17.9165	16.9439 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8861	0.8416	0.7911	0.7136	0.6092	0.4703	0.3393	0.3691	0.5436	0.7317	0.8458	0.8965 (94)
Useful gains	786.2747	906.2706	944.9023	923.5293	816.3285	615.7260	427.9435	444.5592	628.4480	755.6769	762.2630	750.9068 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1712.0091	1696.3955	1561.7694	1326.6921	1033.1407	696.8714	453.6356	477.0162	749.4079	1115.2826	1437.5429	1699.9646 (97)
Space heating kWh	688.7464	530.9639	458.9491	290.2773	161.3083	0.0000	0.0000	0.0000	0.0000	267.5466	486.2015	706.0989 (98a)
Space heating requirement - total per year (kWh/year)	3590.0920											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	688.7464	530.9639	458.9491	290.2773	161.3083	0.0000	0.0000	0.0000	0.0000	267.5466	486.2015	706.0989 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3590.0920											
Space heating per m2	(98c) / (4) =											
	33.0275 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	688.7464	530.9639	458.9491	290.2773	161.3083	0.0000	0.0000	0.0000	0.0000	267.5466	486.2015	706.0989 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	746.2041	575.2589	497.2363	314.4932	174.7652	0.0000	0.0000	0.0000	0.0000	289.8664	526.7622	765.0043 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	244.3357	215.9356	229.3530	201.8900	195.7845	176.5324	174.4638	181.4312	183.4322	204.3698	217.0390	241.7312 (64)
Efficiency of water heater	86.2527	85.9960	85.5837	84.8734	83.6288	79.8000	79.8000	79.8000	79.8000	84.6648	85.8131	79.8000 (216)
Fuel for water heating, kWh/month	283.2788	251.0996	267.9867	237.8718	234.1113	221.2186	218.6263	227.3575	229.8649	241.3870	252.9207	280.0499 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.2623	22.6730	20.4146	14.9566	11.5529	9.4388	10.5389	13.6989	17.7935	23.3461	26.3693	29.0478 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-48.4769	-67.6928	-96.3777	-107.2784	-114.7348	-106.6996	-105.3071	-99.8240	-90.0824	-76.8130	-53.0329	-41.9817 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-29.4184	-61.6388	-122.0822	-182.7696	-241.1383	-242.1505	-239.3698	-202.9787	-149.1359	-88.0366	-39.2349	-23.2883 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3889.5905	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2945.7731	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												228.0927	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2629.5433	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4519.9130	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3889.5905	0.2100	816.8140	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2945.7731	0.2100	618.6124	(264)
Space and water heating			1435.4264	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	228.0927	0.1443	32.9208	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1008.3012	0.1348	-135.9251	
PV Unit electricity exported	-1621.2421	0.1260	-204.2519	
Total			-340.1770	(269)
Total CO2, kg/year			1140.0995	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.4900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3889.5905	1.1300	4395.2372	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2945.7731	1.1300	3328.7237	(278)
Space and water heating			7723.9609	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	228.0927	1.5338	349.8562	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1008.3012	1.4982	-1510.6698	
PV Unit electricity exported	-1621.2421	0.4625	-749.7505	
Total			-2260.4204	(283)
Total Primary energy kWh/year			5943.4976	(286)
Target Primary Energy Rate (TPER)			54.6800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

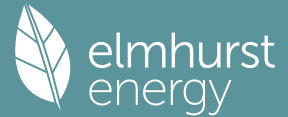
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	53.2000 (1b)	x 2.4000 (2b)	= 127.6800 (1b) - (3b)	
First floor	55.5000 (1c)	x 2.6900 (2c)	= 149.2950 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	108.7000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 276.9750	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1444 (8)
Pressure test		Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3944 (18)
3 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = 1 - [0.075 x (19)] = 0.7750 (20)
(21) = (18) x (20) = 0.3057 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.3897	0.3821	0.3744	0.3362	0.3286	0.2904	0.2904	0.2827	0.3057	0.3286	0.3439	0.3592	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5759	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1000	0.9000	1.8900			(26a)
Windows			13.7000	1.1450	15.6870			(27)
French Doors			11.3500	1.1450	12.9962			(27)
Ground Floor			53.2000	0.1200	6.3840	75.0000	3990.0000	(28a)
Exposed Floor			2.3500	0.2000	0.4700	20.0000	47.0000	(28b)
Wall (cavity)	159.1000	27.1500	131.9500	0.1800	23.7510	18.0000	2375.1000	(29a)
Roof (loft)	53.2000		53.2000	0.1100	5.8520	9.0000	478.8000	(30)
Total net area of external elements Aum(A, m2)			267.8500					(31)
Fabric heat loss, W/K = Sum (A x U)					67.0302			(33)
Main dwelling								
Internal Wall			180.0000			9.0000	1620.0000	(32c)
Internal Floor			53.2000			18.0000	957.6000	(32d)
Internal Ceiling			53.2000			9.0000	478.8000	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) = 67.0302
(26)...(30) + (32) + (32a)...(32e) = 9947.3000 (34)
91.5115 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	21.9000	0.1440	3.1536
E3 Sill	15.5000	0.0480	0.7440
E4 Jamb	35.9000	0.0640	2.2976
E5 Ground floor (normal)	30.4000	0.0510	1.5504
E6 Intermediate floor within a dwelling	27.8000	0.1300	3.6140
E10 Eaves (insulation at ceiling level)	18.7000	0.0750	1.4025
E12 Gable (insulation at ceiling level)	13.5000	0.0620	0.8370
E13 Gable (insulation at rafter level)	0.1000	0.0620	0.0062
E16 Corner (normal)	25.7000	0.0620	1.5934
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	4.4000	0.3200	1.4080

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(36a) = 0.0000
(33) + (36) + (36a) = 83.6369 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	52.6425	52.3729	52.1087	50.8677	50.6355	49.5547	49.5547	49.3545	49.9710	50.6355	51.1052	51.5963	(38)
Average = Sum(39)m / 12 =	136.2794	136.0098	135.7456	134.5046	134.2724	133.1916	133.1916	132.9914	133.6079	134.2724	134.7422	135.2332	(39)
												134.5035	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2537	1.2512	1.2488	1.2374	1.2353	1.2253	1.2253	1.2235	1.2291	1.2353	1.2396	1.2441	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8068 (42)
Hot water usage for mixer showers													(42a)
Hot water usage for baths													(42b)
Hot water usage for other uses													(42c)
Average daily hot water use (litres/day)													(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	74.1505	72.1162	69.8953	67.1313	64.6654	62.1028	61.5706	63.7869	66.0601	68.6917	71.4802	74.0465	(44)
Energy content (annual)	117.4363	102.6925	107.4265	91.8994	87.0521	76.3626	74.4642	78.9816	81.4587	93.2140	101.8366	115.9389	(45)
Distribution loss (46)m = 0.15 x (45)m													(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
WWHRS	99.8209	87.2887	91.3125	78.1145	73.9943	64.9082	63.2946	67.1343	69.2399	79.2319	86.5611	98.5481	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h													
Total per year (kWh/year) = Sum(64)m =	99.8209	87.2887	91.3125	78.1145	73.9943	64.9082	63.2946	67.1343	69.2399	79.2319	86.5611	98.5481	(64)
												959.4491	(64)
												959	(64)

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Electric shower(s)	57.0838	50.8621	55.5395	53.0007	53.9952	51.5062	53.2231	53.9952	53.0007	55.5395	54.4952	57.0838 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												649.3249 (64a)
Heat gains from water heating, kWh/month	39.2262	34.5377	36.7130	32.7788	31.9974	29.1036	29.1294	30.2824	30.5601	33.6929	35.2641	38.9080 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.0200	150.5936	136.0200	140.5540	136.0200	140.5540	136.0200	136.0200	140.5540	136.0200	140.5540	136.0200	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	269.6749	272.4733	265.4214	250.4089	231.4583	213.6474	201.7486	198.9503	206.0021	221.0146	239.9652	257.7761	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	(71)
Water heating gains (Table 5)	52.7233	51.3954	49.3454	45.5261	43.0072	40.4217	39.1524	40.7021	42.4446	45.2861	48.9779	52.2957	(72)
Total internal gains	523.5201	539.5641	515.8888	501.5909	475.5874	459.7250	442.0230	440.7743	454.1027	467.4226	494.5990	511.1937	(73)

6. Solar gains

[Jan]														
					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
North					8.3000	10.6334		0.6300	0.0000		0.7700	42.8135 (74)		
East					0.7000	19.6403		0.6300	0.0000		0.7700	6.6692 (76)		
South					4.7000	46.7521		0.6300	0.0000		0.7700	106.5933 (78)		
South					11.3500	46.7521		0.6300	0.0000		0.7700	257.4115 (78)		
Solar gains	413.4876	691.0114	919.9003	1112.9230	1233.6026	1222.0688	1179.0645	1087.3880	985.4147	755.8749	492.6016	355.7096	(83)	
Total gains	937.0077	1230.5755	1435.7890	1614.5139	1709.1900	1681.7938	1621.0875	1528.1623	1439.5174	1223.2975	987.2006	866.9033	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.2755	20.3157	20.3553	20.5431	20.5786	20.7456	20.7456	20.7768	20.6810	20.5786	20.5069	20.4324	
alpha	2.3517	2.3544	2.3570	2.3695	2.3719	2.3830	2.3830	2.3851	2.3787	2.3719	2.3671	2.3622	
util living area	0.9231	0.8681	0.8031	0.7060	0.5874	0.4518	0.3404	0.3720	0.5379	0.7484	0.8825	0.9339	(86)
MIT	18.3124	18.8620	19.4444	20.0658	20.5309	20.8220	20.9342	20.9167	20.7164	20.0780	19.0825	18.2051	(87)
Th 2	19.8773	19.8792	19.8812	19.8902	19.8919	19.8998	19.8998	19.9013	19.8968	19.8919	19.8885	19.8849	(88)
util rest of house	0.9127	0.8519	0.7795	0.6716	0.5393	0.3872	0.2622	0.2920	0.4731	0.7103	0.8651	0.9249	(89)
MIT 2	17.4627	17.9936	18.5507	19.1356	19.5504	19.7947	19.8720	19.8640	19.7173	19.1658	18.2246	17.3632	(90)
Living area fraction	17.6230	18.1574	18.7192	19.3111	19.7353	19.9884	20.0723	20.0625	19.9057	19.3379	18.3864	17.5220	(91)
MIT	17.6230	18.1574	18.7192	19.3111	19.7353	19.9884	20.0723	20.0625	19.9057	19.3379	18.3864	17.5220	(92)
Temperature adjustment	17.6230	18.1574	18.7192	19.3111	19.7353	19.9884	20.0723	20.0625	19.9057	19.3379	18.3864	17.5220	(93)
adjusted MIT	17.6230	18.1574	18.7192	19.3111	19.7353	19.9884	20.0723	20.0625	19.9057	19.3379	18.3864	17.5220	(93)

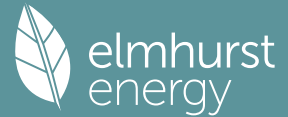
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	829.6116	1010.5408	1078.1812	1052.2839	909.3767	660.4079	445.5994	464.9164	681.8980	842.3699	824.7315	779.5312	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1815.6440	1803.1380	1658.7056	1400.3368	1078.9178	717.6903	462.4819	487.0827	775.6896	1173.2540	1520.7532	1801.5752	(97)
Space heating kWh	733.6082	532.6253	431.9101	250.5981	126.1386	0.0000	0.0000	0.0000	0.0000	246.1778	501.1356	760.4008	(98a)
Space heating requirement - total per year (kWh/year)												3582.5944	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	733.6082	532.6253	431.9101	250.5981	126.1386	0.0000	0.0000	0.0000	0.0000	246.1778	501.1356	760.4008	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3582.5944	
Space heating per m ²										(98c) / (4) =		32.9586	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1252.0007	985.6176	1010.7347	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8345	0.8809	0.8631	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1044.7510	868.2146	872.3489	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1910.3751	1842.0402	1736.1147	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	623.2494	724.5263	642.6418	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													

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0.0000	0.0000	0.0000	0.0000	0.0000	155.8123	181.1316	160.6604	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												497.6043 (107)
Energy for space heating												32.9586 (99)
Energy for space cooling												4.5778 (108)
Total												37.5363 (109)
Fabric Energy Efficiency (DFEE)												37.5 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	53.2000 (1b)	x 2.4000 (2b)	= 127.6800 (1b) - (3b)
First floor	55.5000 (1c)	x 2.6900 (2c)	= 149.2950 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 276.9750 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1444 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3944	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3057 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.3897	0.3821	0.3744	0.3362	0.3286	0.2904	0.2904	0.2827	0.3057	0.3286	0.3439	0.3592	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5759	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
TER Semi-glazed door			2.1000	1.0000	2.1000		(26a)
TER Opening Type			25.0500	1.1450	28.6832		(27)
Ground Floor			53.2000	0.1300	6.9160		(28a)
Exposed Floor			2.3500	0.1300	0.3055		(28b)
Wall (cavity)	159.1000	27.1500	131.9500	0.1800	23.7510		(29a)
Roof (loft)	53.2000		53.2000	0.1100	5.8520		(30)
Total net area of external elements Aum(A, m ²)			267.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.6077		(33)

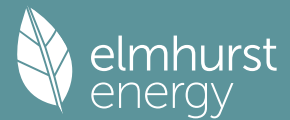
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

List of Thermal Bridges							91.5115 (35)
K1 Element	Length	Psi-value	Total				
E2 Other lintels (including other steel lintels)	21.9000	0.0500	1.0950				
E3 Sill	15.5000	0.0500	0.7750				
E4 Jamb	35.9000	0.0500	1.7950				
E5 Ground floor (normal)	30.4000	0.1600	4.8640				
E6 Intermediate floor within a dwelling	27.8000	0.0000	0.0000				
E10 Eaves (insulation at ceiling level)	18.7000	0.0600	1.1220				
E12 Gable (insulation at ceiling level)	13.5000	0.0600	0.8100				
E13 Gable (insulation at rafter level)	0.1000	0.0800	0.0080				
E16 Corner (normal)	25.7000	0.0900	2.3130				
R1 Head of roof window	0.0000	0.0800	0.0000				
R2 Sill of roof window	0.0000	0.0600	0.0000				
R3 Jamb of roof window	0.0000	0.0800	0.0000				
E20 Exposed floor (normal)	4.4000	0.3200	1.4080				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1900 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	81.7977 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	52.6425	52.3729	52.1087	50.8677	50.6355	49.5547	49.5547	49.3545	49.9710	50.6355	51.1052	51.5963	(38)
	134.4402	134.1706	133.9064	132.6654	132.4332	131.3524	131.3524	131.1522	131.7687	132.4332	132.9030	133.3940	(39)

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Average = Sum(39)m / 12 =

132.6643

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2368	1.2343	1.2319	1.2205	1.2183	1.2084	1.2084	1.2066	1.2122	1.2183	1.2227	1.2272	(40)
HLP (average)												1.2205	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8068 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
30.7762	30.3191	29.6755	28.4887	27.6000	26.6147	26.0824	26.7216	27.4175	28.4719	29.6831	30.6721		(42b)
Hot water usage for other uses													
43.3744	41.7971	40.2199	38.6426	37.0654	35.4881	35.4881	37.0654	38.6426	40.2199	41.7971	43.3744		(42c)
Average daily hot water use (litres/day)												67.9656	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.1505	72.1162	69.8953	67.1313	64.6654	62.1028	61.5706	63.7869	66.0601	68.6917	71.4802	74.0465	(44)
Energy conte	117.4363	102.6925	107.4265	91.8994	87.0521	76.3626	74.4642	78.9816	81.4587	93.2140	101.8366	115.9389	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
99.8209	87.2887	91.3125	78.1145	73.9943	64.9082	63.2946	67.1343	69.2399	79.2319	86.5611	98.5481		(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
99.8209	87.2887	91.3125	78.1145	73.9943	64.9082	63.2946	67.1343	69.2399	79.2319	86.5611	98.5481		(64)
Total per year (kWh/year)												959	(64)
Electric shower(s)													
57.0838	50.8621	55.5395	53.0007	53.9952	51.5062	53.2231	53.9952	53.0007	55.5395	54.4952	57.0838		(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												649.3249	(64a)
Heat gains from water heating, kWh/month													
39.2262	34.5377	36.7130	32.7788	31.9974	29.1036	29.1294	30.2824	30.5601	33.6929	35.2641	38.9080		(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	140.3397	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
136.0200	150.5936	136.0200	140.5540	136.0200	140.5540	136.0200	136.0200	140.5540	136.0200	140.5540	136.0200	136.0200	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
269.6749	272.4733	265.4214	250.4089	231.4583	213.6474	201.7486	198.9503	206.0021	221.0146	239.9652	257.7761		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	37.0340	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	(71)
Water heating gains (Table 5)													
52.7233	51.3954	49.3454	45.5261	43.0072	40.4217	39.1524	40.7021	42.4446	45.2861	48.9779	52.2957		(72)
Total internal gains													
523.5201	539.5641	515.8888	501.5909	475.5874	459.7250	442.0230	440.7743	454.1027	467.4226	494.5990	511.1937		(73)

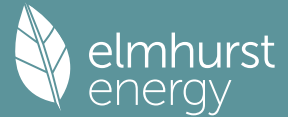
6. Solar gains

[Jan]															
				Area	Solar flux		g		FF		Access	Gains			
				m2	Table 6a		Specific data		Specific data		factor	W			
					W/m2		or Table 6b		or Table 6c		Table 6d				
North				8.3000	10.6334		0.6300		0.7000		0.7700	26.9725 (74)			
East				0.7000	19.6403		0.6300		0.7000		0.7700	4.2016 (76)			
South				16.0500	46.7521		0.6300		0.7000		0.7700	229.3230 (78)			
Solar gains				260.4972	435.3372	579.5372	701.1415	777.1696	769.9033	742.8106	685.0544	620.8113	476.2012	310.3390	224.0970 (83)
Total gains				784.0173	974.9013	1095.4259	1202.7324	1252.7571	1229.6283	1184.8336	1125.8287	1074.9139	943.6238	804.9380	735.2907 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	20.5529	20.5942	20.6348	20.8279	20.8644	21.0361	21.0361	21.0682	20.9696	20.8644	20.7907	20.7141	
alpha	2.3702	2.3729	2.3757	2.3885	2.3910	2.4024	2.4024	2.4045	2.3980	2.3910	2.3860	2.3809	
util living area													
0.9446	0.9108	0.8692	0.7984	0.6991	0.5642	0.4390	0.4728	0.6447	0.8236	0.9173	0.9516		(86)
MIT	18.1170	18.5601	19.1005	19.7568	20.3136	20.7155	20.8881	20.8626	20.5820	19.8424	18.8643	18.0364	(87)
Th 2	19.8907	19.8926	19.8946	19.9037	19.9054	19.9133	19.9133	19.9148	19.9102	19.9054	19.9019	19.8983	(88)
util rest of house													
0.9368	0.8988	0.8512	0.7696	0.6535	0.4939	0.3456	0.3798	0.5795	0.7922	0.9041	0.9447		(89)
MIT 2	17.2817	17.7152	18.2414	18.8742	19.3885	19.7379	19.8636	19.8501	19.6344	18.9703	18.0267	17.2075	(90)
Living area fraction													
MIT	17.4392	17.8746	18.4035	19.0406	19.5630	19.9223	20.0568	20.0410	19.8131	19.1347	18.1846	17.3638	(92)

Full SAP Calculation Printout



Temperature adjustment												0.0000
adjusted MIT	17.4392	17.8746	18.4035	19.0406	19.5630	19.9223	20.0568	20.0410	19.8131	19.1347	18.1846	17.3638 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9133	0.8705	0.8213	0.7433	0.6376	0.4945	0.3587	0.3913	0.5731	0.7657	0.8769	0.9228	(94)
Useful gains	716.0274	848.6730	899.6992	893.9329	798.7604	608.0897	424.9881	440.5658	616.0068	722.5200	705.8117	678.5093	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1766.4423	1740.8043	1593.9496	1345.3086	1041.3173	699.0964	454.0601	477.5276	752.8113	1130.2832	1473.1823	1755.9770	(97)
Space heating kWh	781.5087	599.5122	516.5223	324.9905	180.4623	0.0000	0.0000	0.0000	0.0000	303.3758	552.5068	801.6360	(98a)
Space heating requirement - total per year (kWh/year)												4060.5147	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	781.5087	599.5122	516.5223	324.9905	180.4623	0.0000	0.0000	0.0000	0.0000	303.3758	552.5068	801.6360	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4060.5147	
Space heating per m2										(98c) / (4) =		37.3552	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1234.7122	972.0075	996.7567	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7447	0.8073	0.7851	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	919.4907	784.6597	782.5375	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1381.8701	1332.1331	1265.8547	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	332.9131	407.3202	359.5881	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =				(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	83.2283	101.8301	89.8970	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												274.9554	(107)
Energy for space heating												37.3552	(99)
Energy for space cooling												2.5295	(108)
Total												39.8847	(109)
Fabric Energy Efficiency (TFEE)												39.9	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

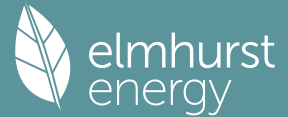
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	53.2000 (1b)	x 2.4000 (2b)	= 127.6800 (1b) - (3b)	
First floor	55.5000 (1c)	x 2.6900 (2c)	= 149.2950 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.7000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	276.9750 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1444 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3944	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3057 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3897	0.3821	0.3744	0.3362	0.3286	0.2904	0.2904	0.2827	0.3057	0.3286	0.3439	0.3592	(22b)
Effective ac	0.5759	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1000	0.9000	1.8900			(26a)
Windows			13.7000	1.1450	15.6870			(27)
French Doors			11.3500	1.1450	12.9962			(27)
Ground Floor			53.2000	0.1200	6.3840	75.0000	3990.0000	(28a)
Exposed Floor			2.3500	0.2000	0.4700	20.0000	47.0000	(28b)
Wall (cavity)	159.1000	27.1500	131.9500	0.1800	23.7510	18.0000	2375.1000	(29a)
Roof (loft)	53.2000		53.2000	0.1100	5.8520	9.0000	478.8000	(30)
Total net area of external elements Aum(A, m2)			267.8500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.0302			(33)
Main dwelling								
Internal Wall			180.0000			9.0000	1620.0000	(32c)
Internal Floor			53.2000			18.0000	957.6000	(32d)
Internal Ceiling			53.2000			9.0000	478.8000	(32e)

Heat capacity Cm = Sum(A x k)

(28)...(30) + (32) + (32a)...(32e) = 9947.3000 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

91.5115 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	21.9000	0.1440	3.1536
E3 Sill	15.5000	0.0480	0.7440
E4 Jamb	35.9000	0.0640	2.2976
E5 Ground floor (normal)	30.4000	0.0510	1.5504
E6 Intermediate floor within a dwelling	27.8000	0.1300	3.6140
E10 Eaves (insulation at ceiling level)	18.7000	0.0750	1.4025
E12 Gable (insulation at ceiling level)	13.5000	0.0620	0.8370
E13 Gable (insulation at rafter level)	0.1000	0.0620	0.0062
E16 Corner (normal)	25.7000	0.0620	1.5934
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	4.4000	0.3200	1.4080

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.6067 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 83.6369 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	52.6425	52.3729	52.1087	50.8677	50.6355	49.5547	49.5547	49.3545	49.9710	50.6355	51.1052	51.5963	(38)
Average = Sum(39)m / 12 =	136.2794	136.0098	135.7456	134.5046	134.2724	133.1916	133.1916	132.9914	133.6079	134.2724	134.7422	135.2332	(39)
												134.5035	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2537	1.2512	1.2488	1.2374	1.2353	1.2253	1.2253	1.2235	1.2291	1.2353	1.2396	1.2441	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

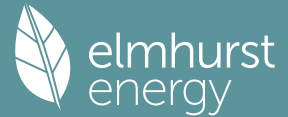
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8068 (42)
Hot water usage for mixer showers													
80.1906	78.9855	77.2294	73.8694	71.3899	68.6247	67.0530	68.7958	70.7062	73.6752	77.1073	79.8833	79.8833	(42a)
Hot water usage for baths													
30.7762	30.3191	29.6755	28.4887	27.6000	26.6147	26.0824	26.7216	27.4175	28.4719	29.6831	30.6721	30.6721	(42b)
Hot water usage for other uses													
43.3744	41.7971	40.2199	38.6426	37.0654	35.4881	35.4881	37.0654	38.6426	40.2199	41.7971	43.3744	43.3744	(42c)
Average daily hot water use (litres/day)												141.8986	(43)
Daily hot water use													
154.3411	151.1017	147.1247	141.0007	136.0553	130.7275	128.6235	132.5827	136.7663	142.3669	148.5875	153.9298	153.9298	(44)
Energy conte	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169	(45)
Energy content (annual)												2356.9230	
Distribution loss (46)m = 0.15 x (45)m													
36.6658	32.2750	33.9188	28.9534	27.4735	24.1117	23.3339	24.6248	25.2970	28.9786	31.7535	36.1525	36.1525	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169	241.0169	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	81.2758	71.5430	75.1866	64.1801	60.8996	53.4476	51.7234	54.5849	56.0750	64.2358	70.3870	80.1381	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
33.0368	29.3430	23.8634	18.0661	13.5046	11.4012	12.3194	16.0132	21.4929	27.2901	31.8516	33.9550	33.9550	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
402.4998	406.6765	396.1514	373.7446	345.4602	318.8767	301.1174	296.9407	307.4658	329.8726	358.1570	384.7405	384.7405	(68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717 (71)
Water heating gains (Table 5)	109.2417	106.4627	101.0573	89.1391	81.8543	74.2328	69.5207	73.3668	77.8819	86.3385	97.7597	107.7125 (72)
Total internal gains	658.5618	656.2657	634.8555	594.7332	554.6025	515.2941	493.7408	497.1041	517.6240	557.2846	601.5517	640.1914 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					8.3000	10.6334	0.6300	0.0000			0.7700			42.8135 (74)
East					0.7000	19.6403	0.6300	0.0000			0.7700			6.6692 (76)
South					4.7000	46.7521	0.6300	0.0000			0.7700			106.5933 (78)
South					11.3500	46.7521	0.6300	0.0000			0.7700			257.4115 (78)
Solar gains	413.4876	691.0114	919.9003	1112.9230	1233.6026	1222.0688	1179.0645	1087.3880	985.4147	755.8749	492.6016	355.7096 (83)		
Total gains	1072.0494	1347.2771	1554.7557	1707.6562	1788.2050	1737.3629	1672.8053	1584.4921	1503.0387	1313.1595	1094.1533	995.9010 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)			
Utilisation factor for gains for living area, nil,m (see Table 9a)																
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
tau	20.2755	20.3157	20.3553	20.5431	20.5786	20.7456	20.7456	20.7768	20.6810	20.5786	20.5069	20.4324				
alpha	2.3517	2.3544	2.3570	2.3695	2.3719	2.3830	2.3830	2.3851	2.3787	2.3719	2.3671	2.3622				
util living area	0.9021	0.8475	0.7797	0.6861	0.5703	0.4403	0.3311	0.3606	0.5216	0.7247	0.8607	0.9146	(86)			
MIT	19.0004	19.3719	19.7885	20.2162	20.5420	20.7457	20.8254	20.8136	20.6730	20.2318	19.5341	18.9197	(87)			
Th 2	19.8773	19.8792	19.8812	19.8902	19.8919	19.8998	19.8998	19.9013	19.8968	19.8919	19.8885	19.8849	(88)			
util rest of house	0.8895	0.8295	0.7546	0.6510	0.5223	0.3767	0.2546	0.2825	0.4575	0.6852	0.8410	0.9035	(89)			
MIT 2	17.5673	18.0253	18.5337	19.0492	19.4206	19.6401	19.7103	19.7036	19.5716	19.0849	18.2436	17.4725	(90)			
Living area fraction									FLA = Living area / (4) =						0.1886	(91)
MIT	17.8376	18.2792	18.7703	19.2693	19.6321	19.8486	19.9206	19.9130	19.7793	19.3012	18.4870	17.7454	(92)			
Temperature adjustment												0.0000				
adjusted MIT	17.8376	18.2792	18.7703	19.2693	19.6321	19.8486	19.9206	19.9130	19.7793	19.3012	18.4870	17.7454	(93)			

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8605	0.7986	0.7259	0.6294	0.5103	0.3736	0.2561	0.2834	0.4502	0.6613	0.8104	0.8758 (94)
Ext temp.	922.5224	1075.9092	1128.6022	1074.7440	912.4591	649.0460	428.4589	449.0081	676.7274	868.4555	886.7114	872.2380 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1844.8943	1819.7078	1665.6435	1394.7149	1065.0574	699.0737	442.2748	467.1941	758.7981	1168.3333	1534.3028	1831.7926 (97)
Space heating requirement - total per year (kWh/year)	686.2447	499.8327	399.5587	230.3791	113.5331	0.0000	0.0000	0.0000	0.0000	223.1091	466.2658	713.9087 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	686.2447	499.8327	399.5587	230.3791	113.5331	0.0000	0.0000	0.0000	0.0000	223.1091	466.2658	713.9087 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3332.8319
Space heating per m2										(98c) / (4) =		30.6608 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
686.2447	499.8327	399.5587	230.3791	113.5331	0.0000	0.0000	0.0000	0.0000	0.0000	223.1091	466.2658	713.9087 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	312.9251	227.9219	182.1973	105.0520	51.7707	0.0000	0.0000	0.0000	0.0000	101.7369	212.6155	325.5398 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169 (64)
Water heating requirement	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Efficiency of water heater (217)m	128.3816	113.0078	118.7632	101.3776	96.1957	84.4248	81.7012	86.2212	88.5749	101.4656	111.1818	126.5845 (219)
Fuel for water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	28.9170	23.1983	20.8875	15.3030	11.8205	9.6575	10.7831	14.0162	18.2057	23.8869	26.9802	29.7207 (232)
Lighting												
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1519.7592	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1237.8797	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												233.3764	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2991.0154	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1519.7592	16.4900	250.6083 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1237.8797	16.4900	204.1264 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	233.3764	16.4900	38.4838 (250)
Additional standing charges			0.0000 (251)
Total energy cost			493.2184 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] = 1.1552 (257)$
SAP value	81.2737
SAP rating (Section 12)	81 (258)
SAP band	B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1519.7592	0.1554	236.2108 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1237.8797	0.1416	175.2568 (264)
Space and water heating			411.4676 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	233.3764	0.1443	33.6834 (268)
Total CO2, kg/year			445.1510 (272)
CO2 emissions per m2			4.1000 (273)
EI value			96.1190
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	53.2000 (1b)	x 2.4000 (2b)	= 127.6800 (1b) - (3b)
First floor	55.5000 (1c)	x 2.6900 (2c)	= 149.2950 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 276.9750 (5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		4 * 10 =	40.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1444 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3944 (18)
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3057 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000	(22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000	(22a)
Adj infiltr rate	0.3668	0.3439	0.3362	0.2980	0.2980	0.2751	0.2827	0.2675	0.2827	0.3057	0.3133	0.3362	(22b)
Effective ac	0.5673	0.5591	0.5565	0.5444	0.5444	0.5378	0.5400	0.5358	0.5400	0.5467	0.5491	0.5565	(25)

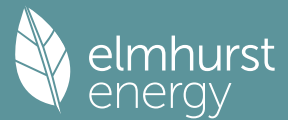
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1000	0.9000	1.8900			(26a)
Windows			13.7000	1.1450	15.6870			(27)
French Doors			11.3500	1.1450	12.9962			(27)
Ground Floor			53.2000	0.1200	6.3840	75.0000	3990.0000	(28a)
Exposed Floor			2.3500	0.2000	0.4700	20.0000	47.0000	(28b)
Wall (cavity)	159.1000	27.1500	131.9500	0.1800	23.7510	18.0000	2375.1000	(29a)
Roof (loft)	53.2000		53.2000	0.1100	5.8520	9.0000	478.8000	(30)
Total net area of external elements Aum(A, m2)			267.8500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.0302			(33)
Main dwelling								
Internal Wall			180.0000			9.0000	1620.0000	(32c)
Internal Floor			53.2000			18.0000	957.6000	(32d)
Internal Ceiling			53.2000			9.0000	478.8000	(32e)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								9947.3000 (34)
								91.5115 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				21.9000	0.1440		3.1536	
E3 Sill				15.5000	0.0480		0.7440	
E4 Jamb				35.9000	0.0640		2.2976	
E5 Ground floor (normal)				30.4000	0.0510		1.5504	
E6 Intermediate floor within a dwelling				27.8000	0.1300		3.6140	
E10 Eaves (insulation at ceiling level)				18.7000	0.0750		1.4025	
E12 Gable (insulation at ceiling level)				13.5000	0.0620		0.8370	
E13 Gable (insulation at rafter level)				0.1000	0.0620		0.0062	
E16 Corner (normal)				25.7000	0.0620		1.5934	
R1 Head of roof window				0.0000	0.2400		0.0000	
R2 Sill of roof window				0.0000	0.2400		0.0000	
R3 Jamb of roof window				0.0000	0.2400		0.0000	
E20 Exposed floor (normal)				4.4000	0.3200		1.4080	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.6067	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	83.6369	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8068 (42)
Hot water usage for mixer showers													
	80.1906	78.9855	77.2294	73.8694	71.3899	68.6247	67.0530	68.7958	70.7062	73.6752	77.1073	79.8833	(42a)
Hot water usage for baths													
	30.7762	30.3191	29.6755	28.4887	27.6000	26.6147	26.0824	26.7216	27.4175	28.4719	29.6831	30.6721	(42b)
Hot water usage for other uses													
	43.3744	41.7971	40.2199	38.6426	37.0654	35.4881	35.4881	37.0654	38.6426	40.2199	41.7971	43.3744	(42c)
Average daily hot water use (litres/day)													141.8986 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	154.3411	151.1017	147.1247	141.0007	136.0553	130.7275	128.6235	132.5827	136.7663	142.3669	148.5875	153.9298	(44)
Energy conte	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169	(45)
Energy content (annual)													Total = Sum(45)m = 2356.9230
Distribution loss (46)m = 0.15 x (45)m													
	36.6658	32.2750	33.9188	28.9534	27.4735	24.1117	23.3339	24.6248	25.2970	28.9786	31.7535	36.1525	(46)
Water storage loss:													
Total storage loss													

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Electric shower(s)	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169 (64)
	Total per year (kWh/year) = Sum(64)m =											2356.9230 (64)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
	81.2758	71.5430	75.1866	64.1801	60.8996	53.4476	51.7234	54.5849	56.0750	64.2358	70.3870	80.1381 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.0368	29.3430	23.8634	18.0661	13.5046	11.4012	12.3194	16.0132	21.4929	27.2901	31.8516	33.9550 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	402.4998	406.6765	396.1514	373.7446	345.4602	318.8767	301.1174	296.9407	307.4658	329.8726	358.1570	384.7405 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717 (71)
Water heating gains (Table 5)	109.2417	106.4627	101.0573	89.1391	81.8543	74.2328	69.5207	73.3668	77.8819	86.3385	97.7597	107.7125 (72)
Total internal gains	658.5618	656.2657	634.8555	594.7332	554.6025	515.2941	493.7408	497.1041	517.6240	557.2846	601.5517	640.1914 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	

North					8.3000	12.7054		0.6300	0.0000		0.7700		51.1561 (74)	
East					0.7000	23.7288		0.6300	0.0000		0.7700		8.0576 (76)	
South					4.7000	53.5774		0.6300	0.0000		0.7700		122.1548 (78)	
South					11.3500	53.5774		0.6300	0.0000		0.7700		294.9908 (78)	

Solar gains	476.3592	707.2997	940.1414	1207.6216	1297.5948	1379.2883	1313.1325	1214.1888	1080.7407	827.5888	572.8402	396.4926 (83)		
Total gains	1134.9210	1363.5654	1574.9968	1802.3549	1852.1972	1894.5824	1806.8734	1711.2929	1598.3647	1384.8734	1174.3919	1036.6840 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.3942	20.5069	20.5431	20.7136	20.7136	20.8073	20.7768	20.8370	20.7768	20.6810	20.6475	20.5431
alpha	2.3596	2.3671	2.3695	2.3809	2.3809	2.3872	2.3851	2.3891	2.3851	2.3787	2.3765	2.3695
util living area	0.8832	0.8356	0.7608	0.6457	0.5166	0.3658	0.2567	0.2624	0.4465	0.6650	0.8241	0.8974 (86)
MIT	19.2015	19.4890	19.9066	20.3377	20.6357	20.7990	20.8503	20.8503	20.7503	20.4082	19.7793	19.1543 (87)
Th 2	19.8830	19.8885	19.8902	19.8983	19.8983	19.9027	19.9013	19.9041	19.9013	19.8968	19.8952	19.8902 (88)
util rest of house	0.8683	0.8161	0.7336	0.6078	0.4648	0.3016	0.1814	0.1835	0.3779	0.6179	0.7993	0.8837 (89)
MIT 2	17.8221	18.1766	18.6833	19.1941	19.5252	19.6892	19.7281	19.7314	19.6485	19.2893	18.5480	17.7708 (90)
Living area fraction	18.0822	18.4241	18.9140	19.4098	19.7346	19.8985	19.9397	19.9424	19.8563	19.5003	18.7802	18.0317 (92)
MIT	18.0822	18.4241	18.9140	19.4098	19.7346	19.8985	19.9397	19.9424	19.8563	19.5003	18.7802	18.0317 (92)
Temperature adjustment	18.0822	18.4241	18.9140	19.4098	19.7346	19.8985	19.9397	19.9424	19.8563	19.5003	18.7802	18.0317 (93)
adjusted MIT	18.0822	18.4241	18.9140	19.4098	19.7346	19.8985	19.9397	19.9424	19.8563	19.5003	18.7802	18.0317 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8382	0.7856	0.7063	0.5895	0.4566	0.3013	0.1841	0.1864	0.3750	0.5991	0.7694	0.8546 (94)
Ext temp.	951.2754	1071.2198	1112.4780	1062.5501	845.7855	570.8413	332.7142	318.9381	599.3587	829.7444	903.5257	885.8987 (95)
Heat loss rate W	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Space heating kWh	1772.4711	1754.8954	1589.0325	1321.9348	951.7410	597.3850	337.7620	323.8766	645.8502	1042.1858	1429.2696	1725.9263 (97)
Space heating requirement - total per year (kWh/year)	610.9696	459.4300	354.5566	186.7570	78.8309	0.0000	0.0000	0.0000	0.0000	158.0565	378.5356	624.9806 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	610.9696	459.4300	354.5566	186.7570	78.8309	0.0000	0.0000	0.0000	0.0000	158.0565	378.5356	624.9806 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (99)
Space heating per m2	(98c) / (4) =											26.2384 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

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Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	219.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	610.9696	459.4300	354.5566	186.7570	78.8309	0.0000	0.0000	0.0000	0.0000	158.0565	378.5356	624.9806	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	278.5999	209.4984	161.6765	85.1605	35.9466	0.0000	0.0000	0.0000	0.0000	72.0732	172.6108	284.9889	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	128.3816	113.0078	118.7632	101.3776	96.1957	84.4248	81.7012	86.2212	88.5749	101.4656	111.1818	126.5845	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	28.9170	23.1983	20.8875	15.3030	11.8205	9.6575	10.7831	14.0162	18.2057	23.8869	26.9802	29.7207	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1300.5548	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1237.8797	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	233.3764	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2771.8110	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1300.5548	26.0600	338.9246	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1237.8797	26.0600	322.5915	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	233.3764	26.0600	60.8179	(250)
Additional standing charges			0.0000	(251)
Total energy cost			722.3339	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1300.5548	0.1560	202.9103	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1237.8797	0.1416	175.2568	(264)
Space and water heating			378.1671	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	233.3764	0.1443	33.6834	(268)
Total CO2, kg/year			411.8505	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1300.5548	1.5776	2051.7528	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1237.8797	1.5235	1885.9574	(278)
Space and water heating			3937.7103	(279)

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Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	233.3764	1.5338	357.9606 (282)
Total Primary energy kWh/year			4295.6708 (286)

SAP 10 EPC IMPROVEMENTS

DB0102

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 76	-36 kg (8.8%)
U Solar photovoltaic panels	+ 7.3	-£ 302	-248 kg (65.9%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£76	0.33 kg/m ²	B 83 A 96
Solar photovoltaic panels	£302	2.28 kg/m ²	B 90 A 98
Total Savings	£378	2.61 kg/m ²	

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£722	£647	£76
Space heating	£339	£360	-£21
Water heating	£323	£226	£96
Lighting	£61	£61	£0
Generated (PV)	-£0	-£302	£302
Total cost of fuels	£722	£345	£378
Total cost of uses	£723	£345	£377
Delivered energy	25 kWh/m ²	5 kWh/m ²	20 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.1 tonnes	0.3 tonnes
CO2 emissions per m ²	4 kg/m ²	1 kg/m ²	3 kg/m ²
Primary energy	40 kWh/m ²	19 kWh/m ²	21 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	53.2000 (1b)	x 2.4000 (2b)	= 127.6800 (1b) - (3b)
First floor	55.5000 (1c)	x 2.6900 (2c)	= 149.2950 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 276.9750 (5)

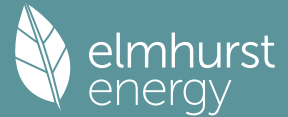
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1444 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3944	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3057 (21)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

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Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3897	0.3821	0.3744	0.3362	0.3286	0.2904	0.2904	0.2827	0.3057	0.3286	0.3439	0.3592 (22b)
	0.5759	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1000	0.9000	1.8900			(26a)
Windows			13.7000	1.1450	15.6870			(27)
French Doors			11.3500	1.1450	12.9962			(27)
Ground Floor			53.2000	0.1200	6.3840	75.0000	3990.0000	(28a)
Exposed Floor			2.3500	0.2000	0.4700	20.0000	47.0000	(28b)
Wall (cavity)	159.1000	27.1500	131.9500	0.1800	23.7510	18.0000	2375.1000	(29a)
Roof (loft)	53.2000		53.2000	0.1100	5.8520	9.0000	478.8000	(30)
Total net area of external elements Aum(A, m2)			267.8500					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	67.0302		(33)
Main dwelling								
Internal Wall			180.0000			9.0000	1620.0000	(32c)
Internal Floor			53.2000			18.0000	957.6000	(32d)
Internal Ceiling			53.2000			9.0000	478.8000	(32e)

Heat capacity Cm = Sum(A x k)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

(28)...(30) + (32) + (32a)...(32e) = 9947.3000 (34)
91.5115 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	21.9000	0.1440	3.1536
E3 Sill	15.5000	0.0480	0.7440
E4 Jamb	35.9000	0.0640	2.2976
E5 Ground floor (normal)	30.4000	0.0510	1.5504
E6 Intermediate floor within a dwelling	27.8000	0.1300	3.6140
E10 Eaves (insulation at ceiling level)	18.7000	0.0750	1.4025
E12 Gable (insulation at ceiling level)	13.5000	0.0620	0.8370
E13 Gable (insulation at rafter level)	0.1000	0.0620	0.0062
E16 Corner (normal)	25.7000	0.0620	1.5934
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	4.4000	0.3200	1.4080

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal Bridges

(36a) = 0.0000
(33) + (36) + (36a) = 83.6369 (37)

Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

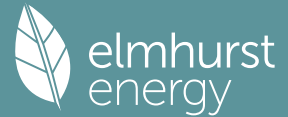
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.6425	52.3729	52.1087	50.8677	50.6355	49.5547	49.5547	49.3545	49.9710	50.6355	51.1052	51.5963 (38)
Average = Sum(39)m / 12 =	136.2794	136.0098	135.7456	134.5046	134.2724	133.1916	133.1916	132.9914	133.6079	134.2724	134.7422	135.2332 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2537	1.2512	1.2488	1.2374	1.2353	1.2253	1.2253	1.2235	1.2291	1.2353	1.2396	1.2441 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8068 (42)
Hot water usage for mixer showers	80.1906	78.9855	77.2294	73.8694	71.3899	68.6247	67.0530	68.7958	70.7062	73.6752	77.1073	79.8833 (42a)
Hot water usage for baths	30.7762	30.3191	29.6755	28.4887	27.6000	26.6147	26.0824	26.7216	27.4175	28.4719	29.6831	30.6721 (42b)
Hot water usage for other uses	43.3744	41.7971	40.2199	38.6426	37.0654	35.4881	35.4881	37.0654	38.6426	40.2199	41.7971	43.3744 (42c)
Average daily hot water use (litres/day)												141.8986 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	154.3411	151.1017	147.1247	141.0007	136.0553	130.7275	128.6235	132.5827	136.7663	142.3669	148.5875	153.9298 (44)
Energy content (annual)	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2356.9230
	36.6658	32.2750	33.9188	28.9534	27.4735	24.1117	23.3339	24.6248	25.2970	28.9786	31.7535	36.1525 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												603.4418 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												603.4418
Solar input	-0.0000	-16.2353	-57.5013	-78.2766	-101.5101	-92.7803	-91.4944	-80.8478	-56.2799	-28.5161	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

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Output from w/h	244.4386	198.9314	168.6239	114.7464	81.6465	67.9645	64.0646	83.3173	112.3666	164.6745	211.6901	241.0169 (64)
	Total per year (kWh/year) = Sum(64)m =											1753.4813 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	81.2758	71.5430	75.1866	64.1801	60.8996	53.4476	51.7234	54.5849	56.0750	64.2358	70.3870	80.1381 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076	168.4076 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.0368	29.3430	23.8634	18.0661	13.5046	11.4012	12.3194	16.0132	21.4929	27.2901	31.8516	33.9550 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	402.4998	406.6765	396.1514	373.7446	345.4602	318.8767	301.1174	296.9407	307.4658	329.8726	358.1570	384.7405 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476	54.6476 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717	-112.2717 (71)
Water heating gains (Table 5)	109.2417	106.4627	101.0573	89.1391	81.8543	74.2328	69.5207	73.3668	77.8819	86.3385	97.7597	107.7125 (72)
Total internal gains	658.5618	656.2657	634.8555	594.7332	554.6025	515.2941	493.7408	497.1041	517.6240	557.2846	601.5517	640.1914 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.3000	10.6334	0.6300	0.0000	0.7700	42.8135 (74)
East	0.7000	19.6403	0.6300	0.0000	0.7700	6.6692 (76)
South	4.7000	46.7521	0.6300	0.0000	0.7700	106.5933 (78)
South	11.3500	46.7521	0.6300	0.0000	0.7700	257.4115 (78)

Solar gains	413.4876	691.0114	919.9003	1112.9230	1233.6026	1222.0688	1179.0645	1087.3880	985.4147	755.8749	492.6016	355.7096 (83)
Total gains	1072.0494	1347.2771	1554.7557	1707.6562	1788.2050	1737.3629	1672.8053	1584.4921	1503.0387	1313.1595	1094.1533	995.9010 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2755	20.3157	20.3553	20.5431	20.5786	20.7456	20.7456	20.7768	20.6810	20.5786	20.5069	20.4324
alpha	2.3517	2.3544	2.3570	2.3695	2.3719	2.3830	2.3830	2.3851	2.3787	2.3719	2.3671	2.3622
util living area	0.9021	0.8475	0.7797	0.6861	0.5703	0.4403	0.3311	0.3606	0.5216	0.7247	0.8607	0.9146 (86)
MIT	19.0004	19.3719	19.7885	20.2162	20.5420	20.7457	20.8254	20.8136	20.6730	20.2318	19.5341	18.9197 (87)
Th 2	19.8773	19.8792	19.8812	19.8902	19.8919	19.8998	19.8998	19.9013	19.8968	19.8919	19.8885	19.8849 (88)
util rest of house	0.8895	0.8295	0.7546	0.6510	0.5223	0.3767	0.2546	0.2825	0.4575	0.6852	0.8410	0.9035 (89)
MIT 2	17.5673	18.0253	18.5337	19.0492	19.4206	19.6401	19.7103	19.7036	19.5716	19.0849	18.2436	17.4725 (90)
Living area fraction	17.8376	18.2792	18.7703	19.2693	19.6321	19.8486	19.9206	19.9130	19.7793	19.3012	18.4870	17.7454 (92)
MIT	17.8376	18.2792	18.7703	19.2693	19.6321	19.8486	19.9206	19.9130	19.7793	19.3012	18.4870	17.7454 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8376	18.2792	18.7703	19.2693	19.6321	19.8486	19.9206	19.9130	19.7793	19.3012	18.4870	17.7454 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8605	0.7986	0.7259	0.6294	0.5103	0.3736	0.2561	0.2834	0.4502	0.6613	0.8104	0.8758 (94)
Useful gains	922.5224	1075.9092	1128.6022	1074.7440	912.4591	649.0460	428.4589	449.0081	676.7274	868.4555	886.7114	872.2380 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1844.8943	1819.7078	1665.6435	1394.7149	1065.0574	699.0737	442.2748	467.1941	758.7981	1168.3333	1534.3028	1831.7926 (97)
Space heating kWh	686.2447	499.8327	399.5587	230.3791	113.5331	0.0000	0.0000	0.0000	0.0000	223.1091	466.2658	713.9087 (98a)
Space heating requirement - total per year (kWh/year)												3332.8319
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	686.2447	499.8327	399.5587	230.3791	113.5331	0.0000	0.0000	0.0000	0.0000	223.1091	466.2658	713.9087 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3332.8319
Space heating per m2										(98c) / (4) =		30.6608 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	686.2447	499.8327	399.5587	230.3791	113.5331	0.0000	0.0000	0.0000	0.0000	223.1091	466.2658	713.9087 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)

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Space heating fuel (main heating system)	312.9251	227.9219	182.1973	105.0520	51.7707	0.0000	0.0000	0.0000	0.0000	101.7369	212.6155	325.5398	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	244.4386	198.9314	168.6239	114.7464	81.6465	67.9645	64.0646	83.3173	112.3666	164.6745	211.6901	241.0169	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	128.3816	104.4808	88.5630	60.2660	42.8816	35.6956	33.6474	43.7591	59.0161	86.4887	111.1818	126.5845	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.5753	6.7945	6.5753	6.7945	6.5753	(231)
Lighting	28.9170	23.1983	20.8875	15.3030	11.8205	9.6575	10.7831	14.0162	18.2057	23.8869	26.9802	29.7207	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-39.0026	-58.3319	-87.4078	-100.0813	-106.3800	-94.0926	-92.6002	-87.1981	-76.9808	-66.4256	-43.7226	-33.3488	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-11.0839	-25.2480	-54.9384	-90.6907	-129.3028	-137.6211	-136.0513	-112.5758	-79.4823	-40.4203	-15.6872	-8.5650	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1519.7592	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												920.9460	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												233.3764	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1026.8423	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1519.7592	16.4900	250.6083	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	920.9460	16.4900	151.8640	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	233.3764	16.4900	38.4838	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.5725	16.4900	-146.0309	
PV Unit electricity exported	-841.6669	5.5900	-47.0492	
Total			-193.0801	(252)
Total energy cost			261.0680	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.6115	(257)
SAP value		90.0879	
SAP rating (Section 12)		90	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1519.7592	0.1554	236.2108	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	920.9460	0.1463	134.7752	(264)
Space and water heating			370.9860	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	233.3764	0.1443	33.6834	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.5725	0.1346	-119.2172	
PV Unit electricity exported	-841.6669	0.1228	-103.3731	
Total			-222.5903	(269)
Total CO2, kg/year			193.1761	(272)

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CO2 emissions per m2 1.7800 (273)
 EI value 98.3158
 EI rating 98 (274)
 EI band A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	53.2000 (1b)	x 2.4000 (2b)	= 127.6800 (1b) - (3b)
First floor	55.5000 (1c)	x 2.6900 (2c)	= 149.2950 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 276.9750 (5)

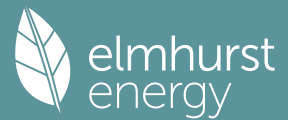
2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	
Pressure test	40.0000 / (5) =	0.1444 (8)
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate	5.0000 (17)	
Number of sides sheltered	0.3944 (18)	
	3 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	
	0.7750 (20)	
	0.3057 (21)	
Wind speed	Jan 4.8000	Feb 4.5000
Wind factor	1.2000	1.1250
Adj infilt rate	0.3668	0.3439
Effective ac	0.5673	0.5591
	Mar 4.4000	Apr 3.9000
	May 3.9000	Jun 3.6000
	Jul 3.7000	Aug 3.5000
	Sep 3.7000	Oct 4.0000
	Nov 4.1000	Dec 4.4000 (22)
	1.2000	1.0250
	0.3668	0.3439
	0.5673	0.5591
	0.3362	0.2980
	0.5444	0.5444
	0.2751	0.2827
	0.5358	0.5400
	0.2827	0.3057
	0.5467	0.5491
	0.3362	0.5565
	0.3362 (22b)	0.5565 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			13.7000	1.1450	15.6870		(27)
French Doors			11.3500	1.1450	12.9962		(27)
Ground Floor			53.2000	0.1200	6.3840	75.0000	3990.0000 (28a)
Exposed Floor			2.3500	0.2000	0.4700	20.0000	47.0000 (28b)
Wall (cavity)	159.1000	27.1500	131.9500	0.1800	23.7510	18.0000	2375.1000 (29a)
Roof (loft)	53.2000		53.2000	0.1100	5.8520	9.0000	478.8000 (30)
Total net area of external elements Aum(A, m2)			267.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.0302		(33)
Main dwelling							
Internal Wall			180.0000			9.0000	1620.0000 (32c)
Internal Floor			53.2000			18.0000	957.6000 (32d)
Internal Ceiling			53.2000			9.0000	478.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9947.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							91.5115 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				21.9000	0.1440	3.1536	
E3 Sill				15.5000	0.0480	0.7440	
E4 Jamb				35.9000	0.0640	2.2976	
E5 Ground floor (normal)				30.4000	0.0510	1.5504	
E6 Intermediate floor within a dwelling				27.8000	0.1300	3.6140	
E10 Eaves (insulation at ceiling level)				18.7000	0.0750	1.4025	
E12 Gable (insulation at ceiling level)				13.5000	0.0620	0.8370	
E13 Gable (insulation at rafter level)				0.1000	0.0620	0.0062	
E16 Corner (normal)				25.7000	0.0620	1.5934	
R1 Head of roof window				0.0000	0.2400	0.0000	
R2 Sill of roof window				0.0000	0.2400	0.0000	
R3 Jamb of roof window				0.0000	0.2400	0.0000	
E20 Exposed floor (normal)				4.4000	0.3200	1.4080	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.6067 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	83.6369 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	Jan 51.8498	Feb 51.1052	Mar 50.8677	Apr 49.7602	May 49.7602	Jun 49.1597	Jul 49.3545
	Aug 48.9702	Sep 49.3545	Oct 49.9710	Nov 50.1872	Dec 50.8677 (38)		

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Heat transfer coeff
135.4868 134.7422 134.5046 133.3971 133.3971 132.7966 132.9914 132.6071 132.9914 133.6079 133.8241 134.5046 (39)
Average = Sum(39)m / 12 = 133.7376

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2464	1.2396	1.2374	1.2272	1.2272	1.2217	1.2235	1.2199	1.2235	1.2291	1.2311	1.2374	(40)
HLP (average)												1.2303	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8068 (42)
Hot water usage for mixer showers 80.1906 78.9855 77.2294 73.8694 71.3899 68.6247 67.0530 68.7958 70.7062 73.6752 77.1073 79.8833 (42a)
Hot water usage for baths 30.7762 30.3191 29.6755 28.4887 27.6000 26.6147 26.0824 26.7216 27.4175 28.4719 29.6831 30.6721 (42b)
Hot water usage for other uses 43.3744 41.7971 40.2199 38.6426 37.0654 35.4881 35.4881 37.0654 38.6426 40.2199 41.7971 43.3744 (42c)
Average daily hot water use (litres/day) 141.8986 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3411	151.1017	147.1247	141.0007	136.0553	130.7275	128.6235	132.5827	136.7663	142.3669	148.5875	153.9298	(44)
Energy conte	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169	(45)
Energy content (annual)												2356.9230	
Distribution loss (46)m = 0.15 x (45)m	36.6658	32.2750	33.9188	28.9534	27.4735	24.1117	23.3339	24.6248	25.2970	28.9786	31.7535	36.1525	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	244.4386	215.1668	226.1252	193.0230	183.1566	160.7447	155.5590	164.1651	168.6465	193.1905	211.6901	241.0169	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												704.3389	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												704.3389	
Solar input	-0.7352	-19.8734	-63.1158	-90.0212	-109.9800	-107.2321	-104.4668	-95.1564	-68.0285	-38.8863	-6.8432	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	243.7034	195.2934	163.0094	103.0018	73.1766	53.5127	51.0922	69.0087	100.6180	154.3042	204.8469	241.0169	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	81.2758	71.5430	75.1866	64.1801	60.8996	53.4476	51.7234	54.5849	56.0750	64.2358	70.3870	80.1381	(65)

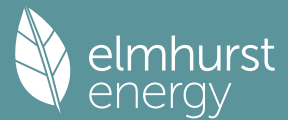
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts
(66)m 168.4076 168.4076 168.4076 168.4076 168.4076 168.4076 168.4076 168.4076 168.4076 168.4076 168.4076 168.4076 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 33.0368 29.3430 23.8634 18.0661 13.5046 11.4012 12.3194 16.0132 21.4929 27.2901 31.8516 33.9550 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 402.4998 406.6765 396.1514 373.7446 345.4602 318.8767 301.1174 296.9407 307.4658 329.8726 358.1570 384.7405 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 54.6476 54.6476 54.6476 54.6476 54.6476 54.6476 54.6476 54.6476 54.6476 54.6476 54.6476 54.6476 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5) -112.2717 -112.2717 -112.2717 -112.2717 -112.2717 -112.2717 -112.2717 -112.2717 -112.2717 -112.2717 -112.2717 -112.2717 (71)
Water heating gains (Table 5) 109.2417 106.4627 101.0573 89.1391 81.8543 74.2328 69.5207 73.3668 77.8819 86.3385 97.7597 107.7125 (72)
Total internal gains 658.5618 656.2657 634.8555 594.7332 554.6025 515.2941 493.7408 497.1041 517.6240 557.2846 601.5517 640.1914 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	8.3000	12.7054	0.6300	0.0000	0.7700	51.1561	(74)						
East	0.7000	23.7288	0.6300	0.0000	0.7700	8.0576	(76)						
South	4.7000	53.5774	0.6300	0.0000	0.7700	122.1548	(78)						
South	11.3500	53.5774	0.6300	0.0000	0.7700	294.9908	(78)						
Solar gains	476.3592	707.2997	940.1414	1207.6216	1297.5948	1379.2883	1313.1325	1214.1888	1080.7407	827.5888	572.8402	396.4926	(83)
Total gains	1134.9210	1363.5654	1574.9968	1802.3549	1852.1972	1894.5824	1806.8734	1711.2929	1598.3647	1384.8734	1174.3919	1036.6840	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.3942	20.5069	20.5431	20.7136	20.7136	20.8073	20.7768	20.8370	20.7768	20.6810	20.6475	20.5431	21.0000 (85)
alpha	2.3596	2.3671	2.3695	2.3809	2.3809	2.3872	2.3851	2.3891	2.3851	2.3787	2.3765	2.3695	
util living area	0.8832	0.8356	0.7608	0.6457	0.5166	0.3658	0.2567	0.2624	0.4465	0.6650	0.8241	0.8974	(86)
MIT	19.2015	19.4890	19.9066	20.3377	20.6357	20.7990	20.8503	20.8503	20.7503	20.4082	19.7793	19.1543	(87)
Th 2	19.8830	19.8885	19.8902	19.8983	19.8983	19.9027	19.9013	19.9041	19.9013	19.8968	19.8952	19.8902	(88)
util rest of house	0.8683	0.8161	0.7336	0.6078	0.4648	0.3016	0.1814	0.1835	0.3779	0.6179	0.7993	0.8837	(89)
MIT 2	17.8221	18.1766	18.6833	19.1941	19.5252	19.6892	19.7281	19.7314	19.6485	19.2893	18.5480	17.7708	(90)
Living area fraction									fLA = Living area / (4) =			0.1886	(91)
MIT	18.0822	18.4241	18.9140	19.4098	19.7346	19.8985	19.9397	19.9424	19.8563	19.5003	18.7802	18.0317	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0822	18.4241	18.9140	19.4098	19.7346	19.8985	19.9397	19.9424	19.8563	19.5003	18.7802	18.0317	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	951.2754	1071.2198	1112.4780	1062.5501	845.7855	570.8413	332.7142	318.9381	599.3587	829.7444	903.5257	885.8987	(94)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(95)
Heat loss rate W	1772.4711	1754.8954	1589.0325	1321.9348	951.7410	597.3850	337.7620	323.8766	645.8502	1042.1858	1429.2696	1725.9263	(96)
Space heating kWh	610.9696	459.4300	354.5566	186.7570	78.8309	0.0000	0.0000	0.0000	0.0000	158.0565	378.5356	624.9806	(98a)
Space heating requirement - total per year (kWh/year)												2852.1167	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	610.9696	459.4300	354.5566	186.7570	78.8309	0.0000	0.0000	0.0000	0.0000	158.0565	378.5356	624.9806	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2852.1167	
Space heating per m2										(98c) / (4) =		26.2384	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													219.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
610.9696	459.4300	354.5566	186.7570	78.8309	0.0000	0.0000	0.0000	0.0000	0.0000	158.0565	378.5356	624.9806	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	278.5999	209.4984	161.6765	85.1605	35.9466	0.0000	0.0000	0.0000	0.0000	72.0732	172.6108	284.9889	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	243.7034	195.2934	163.0094	103.0018	73.1766	53.5127	51.0922	69.0087	100.6180	154.3042	204.8469	241.0169	(64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	127.9955	102.5701	85.6142	54.0976	38.4331	28.1054	26.8342	36.2440	52.8456	81.0421	107.5877	126.5845	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	28.9170	23.1983	20.8875	15.3030	11.8205	9.6575	10.7831	14.0162	18.2057	23.8869	26.9802	29.7207	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.9558	-60.6284	-89.9673	-105.1450	-108.0526	-99.5556	-97.4905	-92.7416	-82.3950	-71.3714	-50.2455	-37.3793	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-14.4845	-27.6669	-59.9988	-106.7034	-143.5851	-164.8867	-160.4281	-134.7600	-94.1010	-49.3863	-20.9742	-10.7072	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1300.5548	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												867.9538	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												233.3764	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1927.6103	(233)
Wind generation												0.0000	(234)

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Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	554.2748 (238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1300.5548	26.0600	338.9246 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	867.9538	26.0600	226.1888 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	233.3764	26.0600	60.8179 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-939.9280	26.0600	-244.9452
PV Unit electricity exported	-987.6823	5.8100	-57.3843
Total			-302.3296 (252)
Total energy cost			344.4497 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1300.5548	0.1560	202.9103 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	867.9538	0.1474	127.9410 (264)
Space and water heating			330.8513 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	233.3764	0.1443	33.6834 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-939.9280	0.1348	-126.6858
PV Unit electricity exported	-987.6823	0.1225	-121.0340
Total			-247.7198 (269)
Total CO2, kg/year			127.9120 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1300.5548	1.5776	2051.7528 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	867.9538	1.5453	1341.2778 (278)
Space and water heating			3393.0306 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	233.3764	1.5338	357.9606 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-939.9280	1.4981	-1408.1519
PV Unit electricity exported	-987.6823	0.4496	-444.0364
Total			-1852.1883 (283)
Total Primary energy kWh/year			2019.8269 (286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 07 Apr 2025 15:03:41

Project Information			
Assessed By	Joe Solti	Building Type	House, Semi-detached
OCDEA Registration	EES/003578	Assessment Date	2025-04-07

Dwelling Details			
Assessment Type	As designed	Total Floor Area	75 m ²
Site Reference	DB0103	Plot Reference	DB0103
Address	R/O Karenza Plot 3 Hook Lane, Aldingbourne		

Client Details	
Name	.
Company	.
Address	., ., .

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	11.78 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	4.61 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	61.54 kWh _{PE} /m ²		
Dwelling primary energy	48.26 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	36.6 kWh/m ²		
Dwelling fabric energy efficiency	34.6 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	Ground Floor (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.16	Windows (N) (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	74.7	0.18	
Party wall: Party Wall (1)	36.4	0 (!)	
Ground floor: Ground Floor, Ground Floor	37.3	0.12	
Exposed roof: Roof (1)	37.3	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front Door, Front Door	2.1	North	N/A	0.9 (!)
Windows (N), Windows	4.1	North	1.0	1.2
Windows (S), Windows	3.3	South	1.0	1.2
Windows (W), Windows	0.8	West	1.0	1.2
French Doors, French Doors	4.6	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.144	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.048	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.064	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.051	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.13	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.062	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.062	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.062	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
External wall	E20: Exposed floor (normal)	SAP table default	0.32	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.044	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.059	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.118	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	5 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

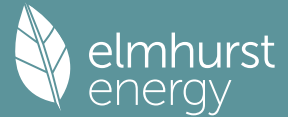
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	219.3%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

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Property Reference	DB0103				Issued on Date	07/04/2025	
Assessment Reference	DB0103			Prop Type Ref	New Dwelling		
Property	Plot 3, R/O Karenza, Hook Lane, Aldingbourne, West Sussex						
SAP Rating	82 B		DER	4.61		TER	11.78
Environmental	96 A		% DER < TER				60.87
CO ₂ Emissions (t/year)	0.31		DFEE	34.56		TFEE	36.62
Compliance Check	See BREL		% DFEE < TFEE				5.61
% DPER < TPER	21.57		DPER	48.26		TPER	61.54
Assessor Details	Mr. Joe Solti					Assessor ID	5122-0001
Client	SBC Limited, .						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 189.8570 (5)

2. Ventilation rate

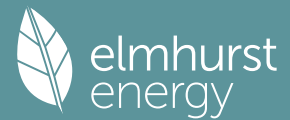
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.2107 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4607 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3916 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4993	0.4895	0.4797	0.4307	0.4210	0.3720	0.3720	0.3622	0.3916	0.4210	0.4405	0.4601 (22b)
Effective ac	0.6246	0.6198	0.6151	0.5928	0.5886	0.5692	0.5692	0.5656	0.5767	0.5886	0.5970	0.6059 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			8.2000	1.1450	9.3893		(27)
French Doors			4.6000	1.1450	5.2672		(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000 (28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000 (29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000 (30)
Total net area of external elements Aum(A, m ²)			164.2000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5715		(33)
Main dwelling							
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000 (32)
Internal Wall			140.0000			9.0000	1260.0000 (32c)
Internal Floor			37.3000			18.0000	671.4000 (32d)
Internal Ceiling			37.3000			9.0000	335.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7472.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.1729 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				12.9000	0.1440	1.8576	

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E3 Sill	9.7000	0.0480	0.4656
E4 Jamb	25.2000	0.0640	1.6128
E5 Ground floor (normal)	17.6000	0.0510	0.8976
E6 Intermediate floor within a dwelling	17.6000	0.1300	2.2880
E10 Eaves (insulation at ceiling level)	17.6000	0.0750	1.3200
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	0.0000	0.0620	0.0000
E16 Corner (normal)	10.2000	0.0620	0.6324
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.7972 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	49.3687 (37)

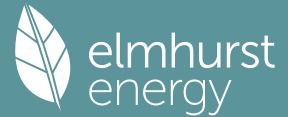
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.1351	38.8318	38.5346	37.1386	36.8774	35.6615	35.6615	35.4364	36.1299	36.8774	37.4058	37.9582 (38)
Average = Sum(39)m / 12 =	88.5038	88.2005	87.9033	86.5073	86.2461	85.0302	85.0302	84.8051	85.4986	86.2461	86.7745	87.3269 (39)
												86.5061
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1864	1.1823	1.1783	1.1596	1.1561	1.1398	1.1398	1.1368	1.1461	1.1561	1.1632	1.1706 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.3524 (42)
Hot water usage for mixer showers												
	71.6201	70.5438	68.9754	65.9745	63.7600	61.2904	59.8866	61.4431	63.1494	65.8010	68.8663	71.3457 (42a)
Hot water usage for baths												
	27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071 (42b)
Hot water usage for other uses												
	38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213 (42c)
Average daily hot water use (litres/day)												126.7294 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	137.8415	134.9487	131.3971	125.9278	121.5112	116.7530	114.8737	118.4094	122.1455	127.1473	132.7029	137.4741 (44)
Energy conte	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (45)
Energy content (annual)										Total = Sum(45)m =		2104.9642
Distribution loss (46)m = 0.15 x (45)m												
	32.7461	28.8248	30.2929	25.8583	24.5366	21.5342	20.8395	21.9923	22.5926	25.8807	28.3590	32.2877 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2104.9642 (64)
Electric shower(s)												2105 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	72.5872	63.8949	67.1492	57.3193	54.3895	47.7342	46.1941	48.7497	50.0804	57.3688	62.8623	71.5710 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	107.9127	119.4748	107.9127	111.5098	107.9127	111.5098	107.9127	107.9127	111.5098	107.9127	111.5098	107.9127 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)												
	97.5634	95.0817	90.2543	79.6101	73.1041	66.2975	62.0889	65.5237	69.5560	77.1086	87.3088	96.1976 (72)
Total internal gains	474.5495	485.7861	463.9632	445.3488	420.6441	400.7111	383.7373	385.0160	398.0789	416.6016	445.0005	464.0157 (73)

6. Solar gains							
[Jan]	Area	Solar flux	g	FF	Access	Gains	
	m2	Table 6a	Specific data	Specific data	factor	W	
		W/m2	or Table 6b	or Table 6c	Table 6d		
North	4.1000	10.6334	0.6300	0.0000	0.7700	21.1489 (74)	
South	3.3000	46.7521	0.6300	0.0000	0.7700	74.8421 (78)	
West	0.8000	19.6403	0.6300	0.0000	0.7700	7.6220 (80)	
South	4.6000	46.7521	0.6300	0.0000	0.7700	104.3254 (78)	

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Solar gains	207.9383	348.7569	467.0106	568.5761	632.7111	627.6631	605.2315	556.5637	501.5865	382.2948	247.9681	178.7159 (83)
Total gains	682.4879	834.5431	930.9737	1013.9249	1053.3552	1028.3742	988.9688	941.5797	899.6653	798.8964	692.9686	642.7316 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.4544	23.5351	23.6146	23.9957	24.0684	24.4126	24.4126	24.4774	24.2788	24.0684	23.9218	23.7705
alpha	2.5636	2.5690	2.5743	2.5997	2.6046	2.6275	2.6275	2.6318	2.6186	2.6046	2.5948	2.5847
util living area	0.9207	0.8762	0.8220	0.7336	0.6187	0.4772	0.3595	0.3894	0.5602	0.7630	0.8830	0.9298 (86)
MIT	19.1622	19.4858	19.8482	20.2639	20.5751	20.7737	20.8452	20.8355	20.7069	20.2951	19.6706	19.1135 (87)
Th 2	19.9309	19.9342	19.9374	19.9524	19.9553	19.9684	19.9684	19.9709	19.9634	19.9553	19.9496	19.9436 (88)
util rest of house	0.9099	0.8605	0.7997	0.7007	0.5715	0.4130	0.2816	0.3104	0.4966	0.7261	0.8655	0.9202 (89)
MIT 2	17.7992	18.2014	18.6483	19.1579	19.5160	19.7353	19.7980	19.7938	19.6698	19.2099	18.4503	17.7474 (90)
Living area fraction									fLA =	Living area / (4) =		0.3164 (91)
MIT	18.2304	18.6077	19.0279	19.5078	19.8511	20.0638	20.1293	20.1233	19.9979	19.5532	18.8363	18.1796 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2304	18.6077	19.0279	19.5078	19.8511	20.0638	20.1293	20.1233	19.9979	19.5532	18.8363	18.1796 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8884	0.8371	0.7777	0.6853	0.5665	0.4192	0.2941	0.3225	0.4988	0.7102	0.8430	0.8997 (94)
Useful gains	606.3294	698.5952	724.0262	694.8401	596.6912	431.1416	290.8686	303.6949	448.7612	567.3566	584.1624	578.2955 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1232.8906	1209.0297	1101.2435	917.6523	702.9982	464.5883	300.0978	315.7571	504.2582	772.1781	1018.4143	1220.7939 (97)
Space heating kWh	466.1615	343.0120	280.6497	160.4248	79.0924	0.0000	0.0000	0.0000	0.0000	152.3873	312.6614	478.0188 (98a)
Space heating requirement - total per year (kWh/year)												2272.4077
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	466.1615	343.0120	280.6497	160.4248	79.0924	0.0000	0.0000	0.0000	0.0000	152.3873	312.6614	478.0188 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2272.4077
Space heating per m2										(98c) / (4) =		30.4612 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	466.1615	343.0120	280.6497	160.4248	79.0924	0.0000	0.0000	0.0000	0.0000	152.3873	312.6614	478.0188 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	212.5679	156.4122	127.9752	73.1531	36.0658	0.0000	0.0000	0.0000	0.0000	69.4880	142.5725	217.9748 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	114.6572	100.9271	106.0675	90.5404	85.9125	75.3999	72.9673	77.0040	79.1059	90.6185	99.2960	113.0521 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (222)
Lighting	22.9415	18.4046	16.5713	12.1408	9.3779	7.6618	8.5548	11.1199	14.4437	18.9509	21.4050	23.5792 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1036.2096 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1105.5484 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

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Total electricity for the above, kWh/year 0.0000 (231)
Electricity for lighting (calculated in Appendix L) 185.1513 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2326.9094 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1036.2096	0.1554	160.9850 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1105.5484	0.1416	156.5215 (264)
Space and water heating			317.5066 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	185.1513	0.1443	26.7231 (268)
Total CO2, kg/year			344.2296 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6100 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1036.2096	1.5752	1632.1873 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1105.5484	1.5235	1684.3455 (278)
Space and water heating			3316.5328 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	185.1513	1.5338	283.9913 (282)
Total Primary energy kWh/year			3600.5241 (286)
Dwelling Primary energy Rate (DPER)			48.2600 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	189.8570 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1580 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4080 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3468 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4422	0.4335	0.4248	0.3815	0.3728	0.3295	0.3295	0.3208	0.3468	0.3728	0.3902	0.4075 (22b)
Effective ac	0.5978	0.5940	0.5902	0.5728	0.5695	0.5543	0.5543	0.5515	0.5601	0.5695	0.5761	0.5830 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Main dwelling													
TER Semi-glazed door			2.1000	1.0000	2.1000			(26a)					
TER Opening Type			12.8000	1.1450	14.6565			(27)					
Ground Floor			37.3000	0.1300	4.8490			(28a)					
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460			(29a)					
Roof (loft)	37.3000		37.3000	0.1100	4.1030			(30)					
Total net area of external elements Aum(A, m2)			164.2000					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1545			(33)					
Main dwelling													
Party Wall			36.4000	0.0000	0.0000			(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.1729	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E2 Other lintels (including other steel lintels)				12.9000	0.0500		0.6450						
E3 Sill				9.7000	0.0500		0.4850						
E4 Jamb				25.2000	0.0500		1.2600						
E5 Ground floor (normal)				17.6000	0.1600		2.8160						
E6 Intermediate floor within a dwelling				17.6000	0.0000		0.0000						
E10 Eaves (insulation at ceiling level)				17.6000	0.0600		1.0560						
E12 Gable (insulation at ceiling level)				0.0000	0.0600		0.0000						
E13 Gable (insulation at rafter level)				0.0000	0.0800		0.0000						
E16 Corner (normal)				10.2000	0.0900		0.9180						
R1 Head of roof window				0.0000	0.0800		0.0000						
R2 Sill of roof window				0.0000	0.0600		0.0000						
R3 Jamb of roof window				0.0000	0.0800		0.0000						
E20 Exposed floor (normal)				0.0000	0.3200		0.0000						
E18 Party wall between dwellings				10.2000	0.0600		0.6120						
P1 Party wall - Ground floor				7.2000	0.0800		0.5760						
P4 Party wall - Roof (insulation at ceiling level)				7.2000	0.1200		0.8640						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2320	(36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	48.3865	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 37.4516	Feb 37.2137	Mar 36.9806	Apr 35.8855	May 35.6807	Jun 34.7269	Jul 34.7269	Aug 34.5503	Sep 35.0943	Oct 35.6807	Nov 36.0951	Dec 36.5284	(38)
Heat transfer coeff	85.8381	85.6002	85.3671	84.2720	84.0672	83.1134	83.1134	82.9368	83.4808	84.0672	84.4816	84.9149	(39)
Average = Sum(39)m / 12 =												84.2711	
HLP	Jan 1.1506	Feb 1.1475	Mar 1.1443	Apr 1.1297	May 1.1269	Jun 1.1141	Jul 1.1141	Aug 1.1118	Sep 1.1190	Oct 1.1269	Nov 1.1325	Dec 1.1383	(40)
HLP (average)												1.1296	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

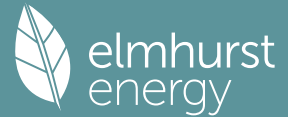
4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.3524 (42)
Hot water usage for mixer showers													
63.6623	62.7056	61.3115	58.6440	56.6756	54.4803	53.2325	54.6161	56.1328	58.4898	61.2145	63.4184	63.4184	(42a)
Hot water usage for baths													
27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071	27.4071	(42b)
Hot water usage for other uses													
38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213	38.7213	(42c)
Average daily hot water use (litres/day)													119.3926 (43)
Daily hot water use	Jan 129.8837	Feb 127.1105	Mar 123.7332	Apr 118.5973	May 114.4267	Jun 109.9430	Jul 108.2196	Aug 111.5823	Sep 115.1289	Oct 119.8361	Nov 125.0511	Dec 129.5468	(44)
Energy conte	205.7040	181.0037	190.1733	162.3538	154.0404	135.1877	130.8822	138.1623	141.9654	162.6164	178.1583	202.8390	(45)
Energy content (annual)										Total = Sum(45)m =		1983.0866	
Distribution loss (46)m = 0.15 x (45)m													
30.8556	27.1506	28.5260	24.3531	23.1061	20.2782	19.6323	20.7243	21.2948	24.3925	26.7237	30.4259	30.4259	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.3938 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7527 (55)
Total storage loss													
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
252.2989	223.0894	236.7682	207.4456	200.6353	180.2795	177.4771	184.7572	187.0573	209.2113	223.2501	249.4339	249.4339	(62)
WWHRS	-29.1037	-25.7396	-26.9530	-22.3182	-20.7997	-17.7985	-16.6832	-17.7409	-18.4150	-21.7092	-24.5939	-28.5648	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	223.1952	197.3498	209.8152	185.1275	179.8355	162.4811	160.7939	167.0162	168.6423	187.5021	198.6562	220.8691	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2261.2841	(64)
Electric shower(s)												2261	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month	105.6725	93.8523	100.5086	90.0561	88.4943	81.0234	80.7943	83.2149	83.2770	91.3459	95.3111	104.7199	(65)

5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	Jan 117.6218	Feb 117.6218	Mar 117.6218	Apr 117.6218	May 117.6218	Jun 117.6218	Jul 117.6218	Aug 117.6218	Sep 117.6218	Oct 117.6218	Nov 117.6218	Dec 117.6218	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
107.9127	119.4748	107.9127	111.5098	107.9127	111.5098	107.9127	111.5098	107.9127	111.5098	107.9127	111.5098	107.9127	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188	198.6188	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													

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	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)	142.0330	139.6612	135.0921	125.0779	118.9440	112.5325	108.5944	111.8479	115.6625	122.7767	132.3765	140.7525 (72)
Total internal gains	519.0191	530.3656	508.8010	490.8166	466.4840	446.9461	430.2428	431.3402	444.1853	462.2697	490.0682	508.5706 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				4.1000	10.6334	0.6300	0.7000		0.7700		13.3238 (74)	
South				7.9000	46.7521	0.6300	0.7000		0.7700		112.8755 (78)	
West				0.8000	19.6403	0.6300	0.7000		0.7700		4.8019 (80)	
Solar gains	131.0011	219.7169	294.2167	358.2030	398.6080	395.4278	381.2958	350.6351	315.9995	240.8457	156.2199	112.5910 (83)
Total gains	650.0203	750.0824	803.0177	849.0195	865.0920	842.3738	811.5387	781.9753	760.1848	703.1155	646.2881	621.1616 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil _m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.1828	24.2500	24.3162	24.6322	24.6922	24.9756	24.9756	25.0288	24.8657	24.6922	24.5711	24.4457
alpha	2.6122	2.6167	2.6211	2.6421	2.6461	2.6650	2.6650	2.6686	2.6577	2.6461	2.6381	2.6297
util living area	0.9265	0.8957	0.8572	0.7881	0.6881	0.5475	0.4194	0.4482	0.6200	0.7993	0.8950	0.9333 (86)
MIT	18.7307	19.0695	19.4966	20.0359	20.4864	20.8045	20.9298	20.9142	20.7109	20.1404	19.3629	18.6782 (87)
Th 2	19.9597	19.9623	19.9648	19.9767	19.9789	19.9893	19.9893	19.9912	19.9853	19.9789	19.9744	19.9697 (88)
util rest of house	0.9165	0.8820	0.8381	0.7589	0.6430	0.4804	0.3333	0.3624	0.5564	0.7659	0.8790	0.9242 (89)
MIT 2	17.3378	17.7607	18.2921	18.9563	19.4853	19.8359	19.9496	19.9399	19.7433	19.0960	18.1427	17.2782 (90)
Living area fraction	17.7784	18.1747	18.6731	19.2978	19.8020	20.1423	20.2597	20.2481	20.0494	19.4264	18.5288	17.7211 (92)
MIT	17.7784	18.1747	18.6731	19.2978	19.8020	20.1423	20.2597	20.2481	20.0494	19.4264	18.5288	17.7211 (93)
Temperature adjustment												0.0000
adjusted MIT	17.7784	18.1747	18.6731	19.2978	19.8020	20.1423	20.2597	20.2481	20.0494	19.4264	18.5288	17.7211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8890	0.8525	0.8095	0.7368	0.6345	0.4911	0.3572	0.3852	0.5608	0.7450	0.8507	0.8978 (94)
Useful gains	577.8613	639.4685	650.0173	625.5441	548.8750	413.7243	289.8684	301.1991	426.2810	523.8041	549.7759	557.6525 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1156.9629	1136.3206	1039.1847	876.2455	681.1146	460.6433	304.1699	319.1526	496.6647	742.0128	965.5201	1148.1438 (97)
Space heating kWh	430.8515	333.8846	289.5405	180.5050	98.3862	0.0000	0.0000	0.0000	0.0000	162.3472	299.3358	439.3255 (98a)
Space heating requirement - total per year (kWh/year)												2234.1764
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	430.8515	333.8846	289.5405	180.5050	98.3862	0.0000	0.0000	0.0000	0.0000	162.3472	299.3358	439.3255 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2234.1764
Space heating per m2										(98c) / (4) =		29.9487 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	430.8515	333.8846	289.5405	180.5050	98.3862	0.0000	0.0000	0.0000	0.0000	162.3472	299.3358	439.3255 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	466.7947	361.7384	313.6950	195.5634	106.5940	0.0000	0.0000	0.0000	0.0000	175.8908	324.3075	475.9757 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	223.1952	197.3498	209.8152	185.1275	179.8355	162.4811	160.7939	167.0162	168.6423	187.5021	198.6562	220.8691 (64)
Efficiency of water heater (217)m	85.5090	85.2291	84.7824	84.0031	82.7664	79.8000	79.8000	79.8000	79.8000	83.7384	84.9769	79.8000 (216)
Fuel for water heating, kWh/month	261.0195	231.5522	247.4751	220.3817	217.2809	203.6104	201.4961	209.2935	211.3312	223.9142	233.7768	258.1113 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	22.4221	17.9879	16.1961	11.8659	9.1656	7.4884	8.3612	10.8682	14.1167	18.5218	20.9204	23.0453 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-34.9149	-49.2318	-70.7838	-79.6152	-85.8835	-80.1828	-79.1959	-74.7493	-66.9044	-56.3101	-38.3893	-30.1853 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-19.6997	-41.4462	-82.3846	-123.7455	-163.6291	-164.4057	-162.4666	-137.5541	-100.8182	-59.2705	-26.3022	-15.5773 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2420.5595 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												2719.2429 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												180.9595 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1843.6460 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3563.1159 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2420.5595	0.2100	508.3175 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2719.2429	0.2100	571.0410 (264)
Space and water heating			1079.3585 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	180.9595	0.1443	26.1180 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-746.3462	0.1346	-100.4418
PV Unit electricity exported	-1097.2997	0.1259	-138.1440
Total			-238.5859 (269)
Total CO2, kg/year			878.8199 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.7800 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2420.5595	1.1300	2735.2322 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2719.2429	1.1300	3072.7444 (278)
Space and water heating			5807.9767 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	180.9595	1.5338	277.5617 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-746.3462	1.4974	-1117.5619
PV Unit electricity exported	-1097.2997	0.4621	-507.0836
Total			-1624.6455 (283)
Total Primary energy kWh/year			4590.9936 (286)
Target Primary Energy Rate (TPER)			61.5400 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

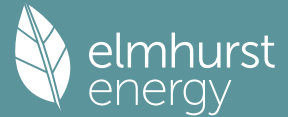
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 189.8570 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)

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Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1580 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4080	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3468 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.4422	0.4335	0.4248	0.3815	0.3728	0.3295	0.3295	0.3208	0.3468	0.3728	0.3902	0.4075	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5978	0.5940	0.5902	0.5728	0.5695	0.5543	0.5543	0.5515	0.5601	0.5695	0.5761	0.5830	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1000	0.9000	1.8900			(26a)
Windows			8.2000	1.1450	9.3893			(27)
French Doors			4.6000	1.1450	5.2672			(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000	(28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000	(29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000	(30)
Total net area of external elements Aum(A, m2)			164.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5715			(33)
Main dwelling								
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000	(32)
Internal Wall			140.0000			9.0000	1260.0000	(32c)
Internal Floor			37.3000			18.0000	671.4000	(32d)
Internal Ceiling			37.3000			9.0000	335.7000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7472.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.1729 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	12.9000	0.1440	1.8576
E2 Other lintels (including other steel lintels)	9.7000	0.0480	0.4656
E3 Sill	25.2000	0.0640	1.6128
E4 Jamb	17.6000	0.0510	0.8976
E5 Ground floor (normal)	17.6000	0.1300	2.2880
E6 Intermediate floor within a dwelling	17.6000	0.0750	1.3200
E10 Eaves (insulation at ceiling level)	0.0000	0.0620	0.0000
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	10.2000	0.0620	0.6324
E16 Corner (normal)	0.0000	0.2400	0.0000
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.7972 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	49.3687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

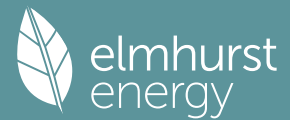
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	37.4516	37.2137	36.9806	35.8855	35.6807	34.7269	34.7269	34.5503	35.0943	35.6807	36.0951	36.5284	(38)
Average = Sum(39)m / 12 =	86.8203	86.5824	86.3493	85.2542	85.0494	84.0956	84.0956	83.9190	84.4630	85.0494	85.4638	85.8971	(39)
												85.2533	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1638	1.1606	1.1575	1.1428	1.1401	1.1273	1.1273	1.1249	1.1322	1.1401	1.1456	1.1514	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.3524 (42)
Hot water usage for mixer showers													(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Hot water usage for other uses	27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071	(42b)
Average daily hot water use (litres/day)	38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213	(42c)
												60.6981	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	66.2214	64.4049	62.4218	59.9533	57.7512	55.4627	54.9871	56.9662	58.9961	61.3463	63.8366	66.1284	(44)
Energy content (annual)	104.8785	91.7118	95.9399	82.0730	77.7442	68.1978	66.5021	70.5361	72.7481	83.2463	90.9470	103.5411	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss													
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

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Total heat required for water heating calculated for each month												
	89.1467	77.9550	81.5489	69.7621	66.0826	57.9681	56.5268	59.9557	61.8359	70.7594	77.3049	88.0100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	89.1467	77.9550	81.5489	69.7621	66.0826	57.9681	56.5268	59.9557	61.8359	70.7594	77.3049	88.0100 (64)
12Total per year (kWh/year)								Total per year (kWh/year) =	Sum(64)m =			856.8561 (64)
Electric shower(s)	50.9829	45.4262	49.6036	47.3362	48.2244	46.0014	47.5348	48.2244	47.3362	49.6036	48.6709	50.9829 (64a)
												579.9275 (64a)
Heat gains from water heating, kWh/month												
	35.0324	30.8453	32.7881	29.2746	28.5767	25.9924	26.0154	27.0450	27.2930	30.0908	31.4940	34.7482 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	107.9127	119.4748	107.9127	111.5098	107.9127	111.5098	107.9127	107.9127	111.5098	107.9127	111.5098	107.9127 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622 (69)
Pumps, fans												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)												
	47.0866	45.9007	44.0701	40.6591	38.4096	36.1005	34.9669	36.3508	37.9070	40.4446	43.7416	46.7046 (72)
Total internal gains	421.0727	433.6052	414.7789	403.3978	382.9495	370.5141	356.6153	355.8431	366.4298	376.9376	398.4333	411.5226 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				4.1000	10.6334		0.6300		0.0000		0.7700		21.1489 (74)
South				3.3000	46.7521		0.6300		0.0000		0.7700		74.8421 (78)
West				0.8000	19.6403		0.6300		0.0000		0.7700		7.6220 (80)
South				4.6000	46.7521		0.6300		0.0000		0.7700		104.3254 (78)
Solar gains	207.9383	348.7569	467.0106	568.5761	632.7111	627.6631	605.2315	556.5637	501.5865	382.2948	247.9681	178.7159	(83)
Total gains	629.0110	782.3621	881.7895	971.9739	1015.6607	998.1773	961.8468	912.4068	868.0162	759.2324	646.4014	590.2385	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.9092	23.9749	24.0396	24.3484	24.4071	24.6839	24.6839	24.7358	24.5765	24.4071	24.2887	24.1662
alpha	2.5939	2.5983	2.6026	2.6232	2.6271	2.6456	2.6456	2.6491	2.6384	2.6271	2.6192	2.6111
util living area	0.9317	0.8882	0.8344	0.7452	0.6290	0.4850	0.3652	0.3970	0.5706	0.7771	0.8959	0.9404 (86)
MIT	18.6523	19.0980	19.5939	20.1588	20.5831	20.8511	20.9484	20.9343	20.7597	20.1929	19.3349	18.5763 (87)
Th 2	19.9491	19.9516	19.9542	19.9660	19.9682	19.9786	19.9786	19.9805	19.9746	19.9682	19.9637	19.9590 (88)
util rest of house	0.9223	0.8737	0.8133	0.7131	0.5823	0.4208	0.2870	0.3175	0.5072	0.7415	0.8799	0.9320 (89)
MIT 2	17.8332	18.2658	18.7432	19.2809	19.6618	19.8898	19.9565	19.9507	19.8210	19.3277	18.5126	17.7659 (90)
Living area fraction									fLA = Living area / (4) =			0.3164 (91)
MIT	18.0923	18.5291	19.0123	19.5586	19.9533	20.1939	20.2703	20.2619	20.1180	19.6014	18.7728	18.0223 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0923	18.5291	19.0123	19.5586	19.9533	20.1939	20.2703	20.2619	20.1180	19.6014	18.7728	18.0223 (93)

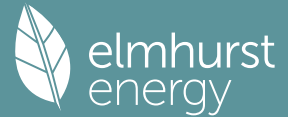
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9008	0.8500	0.7912	0.6992	0.5815	0.4349	0.3099	0.3401	0.5166	0.7273	0.8574	0.9119 (94)
Useful gains	566.6324	664.9813	697.7025	679.6166	590.6566	434.0944	298.1236	310.3045	448.4243	552.1909	554.2008	538.2119 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1197.4551	1180.0363	1080.4275	908.6917	701.9360	470.4242	308.6527	324.0867	508.2943	765.5645	997.5986	1187.2955 (97)
Space heating kWh	469.3321	346.1169	284.7474	164.9340	82.7918	0.0000	0.0000	0.0000	0.0000	158.7499	319.2464	482.9182 (98a)
Space heating requirement - total per year (kWh/year)												2308.8368
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	469.3321	346.1169	284.7474	164.9340	82.7918	0.0000	0.0000	0.0000	0.0000	158.7499	319.2464	482.9182 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2308.8368
Space heating per m2										(98c) / (4) =		30.9496 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	790.4987	622.3075	637.7843	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8381	0.8868	0.8699	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	662.5130	551.8495	554.8300	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1123.3878	1083.1121	1027.4525	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	331.8299	395.2594	351.6311	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	82.9575	98.8148	87.9078	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												269.6801	(107)
Energy for space heating												30.9496	(99)
Energy for space cooling												3.6150	(108)
Total												34.5646	(109)
Fabric Energy Efficiency (DFEE)												34.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	189.8570 (5)

2. Ventilation rate

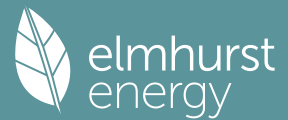
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1580 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4080 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3468 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1750	1.1750 (22a)
Adj infilt rate	0.4422	0.4335	0.4248	0.3815	0.3728	0.3295	0.3295	0.3208	0.3468	0.3728	0.3902	0.4075 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5978	0.5940	0.5902	0.5728	0.5695	0.5543	0.5543	0.5515	0.5601	0.5695	0.5761	0.5830 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Semi-glazed door			2.1000	1.0000	2.1000		(26a)
TER Opening Type			12.8000	1.1450	14.6565		(27)
Ground Floor			37.3000	0.1300	4.8490		(28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460		(29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030		(30)
Total net area of external elements Aum(A, m2)			164.2000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	39.1545	(33)
Main dwelling							
Party Wall			36.4000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.1729 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				12.9000	0.0500	0.6450	
E3 Sill				9.7000	0.0500	0.4850	
E4 Jamb				25.2000	0.0500	1.2600	
E5 Ground floor (normal)				17.6000	0.1600	2.8160	
E6 Intermediate floor within a dwelling				17.6000	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)				17.6000	0.0600	1.0560	
E12 Gable (insulation at ceiling level)				0.0000	0.0600	0.0000	
E13 Gable (insulation at rafter level)				0.0000	0.0800	0.0000	
E16 Corner (normal)				10.2000	0.0900	0.9180	
R1 Head of roof window				0.0000	0.0800	0.0000	
R2 Sill of roof window				0.0000	0.0600	0.0000	

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R3 Jamb of roof window	0.0000	0.0800	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0600	0.6120
P1 Party wall - Ground floor	7.2000	0.0800	0.5760
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1200	0.8640
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.2320 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	48.3865 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	37.4516	37.2137	36.9806	35.8855	35.6807	34.7269	34.7269	34.5503	35.0943	35.6807	36.0951	36.5284 (38)
Average = Sum(39)m / 12 =	85.8381	85.6002	85.3671	84.2720	84.0672	83.1134	83.1134	82.9368	83.4808	84.0672	84.4816	84.9149 (39)
												84.2711
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1506	1.1475	1.1443	1.1297	1.1269	1.1141	1.1141	1.1118	1.1190	1.1269	1.1325	1.1383 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.3524 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071 (42b)
Hot water usage for other uses	38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213 (42c)
Average daily hot water use (litres/day)												60.6981 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	66.2214	64.4049	62.4218	59.9533	57.7512	55.4627	54.9871	56.9662	58.9961	61.3463	63.8366	66.1284 (44)
Energy content (annual)	104.8785	91.7118	95.9399	82.0730	77.7442	68.1978	66.5021	70.5361	72.7481	83.2463	90.9470	103.5411 (45)
Distribution loss (46)m = 0.15 x (45)m												1008.0659
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	89.1467	77.9550	81.5489	69.7621	66.0826	57.9681	56.5268	59.9557	61.8359	70.7594	77.3049	88.0100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	89.1467	77.9550	81.5489	69.7621	66.0826	57.9681	56.5268	59.9557	61.8359	70.7594	77.3049	88.0100 (64)
12Total per year (kWh/year)												856.8561 (64)
Electric shower(s)	50.9829	45.4262	49.6036	47.3362	48.2244	46.0014	47.5348	48.2244	47.3362	49.6036	48.6709	50.9829 (64a)
Heat gains from water heating, kWh/month	35.0324	30.8453	32.7881	29.2746	28.5767	25.9924	26.0154	27.0450	27.2930	30.0908	31.4940	34.7482 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	107.9127	119.4748	107.9127	111.5098	107.9127	111.5098	107.9127	107.9127	111.5098	107.9127	111.5098	107.9127 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188 (68)
Pumps, fans	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Total internal gains	47.0866	45.9007	44.0701	40.6591	38.4096	36.1005	34.9669	36.3508	37.9070	40.4446	43.7416	46.7046 (72)
	421.0727	433.6052	414.7789	403.3978	382.9495	370.5141	356.6153	355.8431	366.4298	376.9376	398.4333	411.5226 (73)

6. Solar gains															
[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North				4.1000	10.6334	0.6300	0.7000	0.7700	13.3238 (74)						
South				7.9000	46.7521	0.6300	0.7000	0.7700	112.8755 (78)						
West				0.8000	19.6403	0.6300	0.7000	0.7700	4.8019 (80)						
Solar gains				131.0011	219.7169	294.2167	358.2030	398.6080	395.4278	381.2958	350.6351	315.9995	240.8457	156.2199	112.5910 (83)
Total gains				552.0739	653.3220	708.9956	761.6007	781.5576	765.9419	737.9111	706.4782	682.4292	617.7833	554.6532	524.1136 (84)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)

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Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.1828	24.2500	24.3162	24.6322	24.6922	24.9756	24.9756	25.0288	24.8657	24.6922	24.5711	24.4457
alpha	2.6122	2.6167	2.6211	2.6421	2.6461	2.6650	2.6650	2.6686	2.6577	2.6461	2.6381	2.6297
util living area	0.9475	0.9200	0.8856	0.8211	0.7259	0.5855	0.4539	0.4864	0.6626	0.8370	0.9220	0.9533 (86)
MIT	18.5145	18.8761	19.3313	19.9156	20.4095	20.7693	20.9150	20.8953	20.6581	20.0167	19.1787	18.4585 (87)
Th 2	19.9597	19.9623	19.9648	19.9767	19.9789	19.9893	19.9893	19.9912	19.9853	19.9789	19.9744	19.9697 (88)
util rest of house	0.9399	0.9089	0.8693	0.7945	0.6825	0.5172	0.3631	0.3962	0.5996	0.8073	0.9092	0.9466 (89)
MIT 2	17.7066	18.0614	18.5061	19.0737	19.5313	19.8462	19.9512	19.9416	19.7585	19.1814	18.3718	17.6584 (90)
Living area fraction									FLA = Living area / (4) =			0.3164 (91)
MIT	17.9622	18.3191	18.7672	19.3401	19.8091	20.1382	20.2561	20.2433	20.0431	19.4457	18.6270	17.9115 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9622	18.3191	18.7672	19.3401	19.8091	20.1382	20.2561	20.2433	20.0431	19.4457	18.6270	17.9115 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9208	0.8868	0.8464	0.7755	0.6745	0.5279	0.3881	0.4199	0.6035	0.7891	0.8881	0.9287 (94)
Useful gains	508.3732	579.3590	600.0909	590.6056	527.1568	404.3690	286.3934	296.6413	411.8205	487.5117	492.5632	486.7245 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1172.7340	1148.6793	1047.2110	879.8054	681.7106	460.3005	303.8710	318.7505	496.1355	743.6305	973.8230	1164.3146 (97)
Space heating kWh	494.2844	382.5832	332.6574	208.2238	114.9880	0.0000	0.0000	0.0000	0.0000	190.5524	346.5071	504.1270 (98a)
Space heating requirement - total per year (kWh/year)												2573.9234
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	494.2844	382.5832	332.6574	208.2238	114.9880	0.0000	0.0000	0.0000	0.0000	190.5524	346.5071	504.1270 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2573.9234
Space heating per m2										(98c) / (4) =		34.5030 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	781.2661	615.0392	630.3196	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7578	0.8222	0.8023	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	592.0684	505.7012	505.7012	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	851.9439	821.3691	786.7567	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	187.1104	234.8569	209.1053	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	46.7776	58.7142	52.2763	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												157.7681 (107)
Energy for space heating												34.5030 (99)
Energy for space cooling												2.1149 (108)
Total												36.6178 (109)
Fabric Energy Efficiency (TFEE)												36.6 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

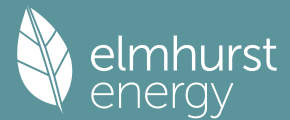
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	189.8570 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	40.0000 / (5) = 0.2107 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50												5.0000 (17)
Infiltration rate												0.4607 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3916 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.4993	0.4895	0.4797	0.4307	0.4210	0.3720	0.3720	0.3622	0.3916	0.4210	0.4405	0.4601 (22b)
	0.6246	0.6198	0.6151	0.5928	0.5886	0.5692	0.5692	0.5656	0.5767	0.5886	0.5970	0.6059 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			8.2000	1.1450	9.3893		(27)
French Doors			4.6000	1.1450	5.2672		(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000 (28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000 (29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000 (30)
Total net area of external elements Aum(A, m2)			164.2000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 38.5715		(33)
Main dwelling							
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000 (32)
Internal Wall			140.0000			9.0000	1260.0000 (32c)
Internal Floor			37.3000			18.0000	671.4000 (32d)
Internal Ceiling			37.3000			9.0000	335.7000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 7472.9000 (34)
List of Thermal Bridges
100.1729 (35)

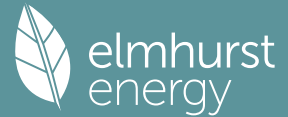
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.1440	1.8576
E3 Sill	9.7000	0.0480	0.4656
E4 Jamb	25.2000	0.0640	1.6128
E5 Ground floor (normal)	17.6000	0.0510	0.8976
E6 Intermediate floor within a dwelling	17.6000	0.1300	2.2880
E10 Eaves (insulation at ceiling level)	17.6000	0.0750	1.3200
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	0.0000	0.0620	0.0000
E16 Corner (normal)	10.2000	0.0620	0.6324
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.7972 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 49.3687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.1351	38.8318	38.5346	37.1386	36.8774	35.6615	35.6615	35.4364	36.1299	36.8774	37.4058	37.9582 (38)
Average = Sum(39)m / 12 =	88.5038	88.2005	87.9033	86.5073	86.2461	85.0302	85.0302	84.8051	85.4986	86.2461	86.7745	87.3269 (39)
												86.5061
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1864	1.1823	1.1783	1.1596	1.1561	1.1398	1.1398	1.1368	1.1461	1.1561	1.1632	1.1706 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3524 (42)
Hot water usage for mixer showers												71.3457 (42a)
Hot water usage for baths												27.4071 (42b)
Hot water usage for other uses												38.7213 (42c)
Average daily hot water use (litres/day)												126.7294 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	137.8415	134.9487	131.3971	125.9278	121.5112	116.7530	114.8737	118.4094	122.1455	127.1473	132.7029	137.4741 (44)
Energy content (annual)	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (45)
Distribution loss (46)m = 0.15 x (45)m												2104.9642
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (64)
Electric shower(s)												2104.9642 (64)
Total per year (kWh/year) = Sum(64)m =												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	72.5872	63.8949	67.1492	57.3193	54.3895	47.7342	46.1941	48.7497	50.0804	57.3688	62.8623	71.5710 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	26.2101	23.2796	18.9322	14.3329	10.7140	9.0452	9.7737	12.7042	17.0516	21.6509	25.2698	26.9385 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	310.1297	313.3478	305.2381	287.9736	266.1801	245.6974	232.0136	228.7954	236.9051	254.1697	275.9632	296.4459 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)												
	97.5634	95.0817	90.2543	79.6101	73.1041	66.2975	62.0889	65.5237	69.5560	77.1086	87.3088	96.1976 (72)
Total internal gains	535.4189	533.2249	515.9405	483.4324	451.5141	419.5558	402.3920	405.5392	422.0285	454.4450	490.0575	521.0979 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	

North					4.1000	10.6334	0.6300	0.0000			0.7700	21.1489 (74)	
South					3.3000	46.7521	0.6300	0.0000			0.7700	74.8421 (78)	
West					0.8000	19.6403	0.6300	0.0000			0.7700	7.6220 (80)	
South					4.6000	46.7521	0.6300	0.0000			0.7700	104.3254 (78)	

Solar gains	207.9383	348.7569	467.0106	568.5761	632.7111	627.6631	605.2315	556.5637	501.5865	382.2948	247.9681	178.7159 (83)	
Total gains	743.3572	881.9819	982.9511	1052.0085	1084.2252	1047.2190	1007.6235	962.1029	923.6150	836.7398	738.0256	699.8138 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	23.4544	23.5351	23.6146	23.9957	24.0684	24.4126	24.4126	24.4774	24.2788	24.0684	23.9218	23.7705	
util living area	2.5636	2.5690	2.5743	2.5997	2.6046	2.6275	2.6275	2.6318	2.6186	2.6046	2.5948	2.5847	
	0.9066	0.8636	0.8062	0.7204	0.6073	0.4704	0.3535	0.3822	0.5498	0.7472	0.8691	0.9170 (86)	
MIT	19.2543	19.5475	19.9034	20.2926	20.5889	20.7774	20.8467	20.8376	20.7147	20.3271	19.7307	19.2032 (87)	
Th 2	19.9309	19.9342	19.9374	19.9524	19.9553	19.9684	19.9684	19.9709	19.9634	19.9553	19.9496	19.9436 (88)	
util rest of house													
	0.8943	0.8468	0.7828	0.6869	0.5601	0.4067	0.2767	0.3043	0.4865	0.7093	0.8501	0.9059 (89)	
MIT 2	17.9128	18.2761	18.7132	19.1897	19.5298	19.7384	19.7989	19.7951	19.6766	19.2450	18.5226	17.8585 (90)	
Living area fraction													
MIT	18.3372	18.6783	19.0897	19.5386	19.8648	20.0671	20.1304	20.1249	20.0050	19.5873	18.9048	18.2839 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.3372	18.6783	19.0897	19.5386	19.8648	20.0671	20.1304	20.1249	20.0050	19.5873	18.9048	18.2839 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8718	0.8234	0.7615	0.6724	0.5557	0.4131	0.2891	0.3164	0.4892	0.6944	0.8275	0.8843 (94)	
Ext temp.	648.0426	726.1962	748.4882	707.3528	602.5208	432.5679	291.3297	304.3713	451.8389	581.0392	610.7425	618.8635 (95)	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Space heating kWh	1242.3444	1215.2563	1106.6787	920.3198	704.1851	464.8656	300.1884	315.8895	504.8716	775.1218	1024.3552	1229.9016 (97)	
Space heating requirement - total per year (kWh/year)	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98a)	
Solar heating kWh												2163.0879	
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)	
Space heating kWh	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												2163.0879	
Space heating per m2												28.9958 (99)	

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													219.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98)	
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)	
Space heating fuel (main heating system)	201.6236	149.8624	121.5202	69.9207	34.4908	0.0000	0.0000	0.0000	0.0000	65.8447	135.7962	207.3016 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	114.6572	100.9271	106.0675	90.5404	85.9125	75.3999	72.9673	77.0040	79.1059	90.6185	99.2960	113.0521	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	22.9415	18.4046	16.5713	12.1408	9.3779	7.6618	8.5548	11.1199	14.4437	18.9509	21.4050	23.5792	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												986.3602	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1105.5484	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												185.1513	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2277.0600	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	986.3602	16.4900	162.6508 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1105.5484	16.4900	182.3049 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	185.1513	16.4900	30.5315 (250)
Additional standing charges			0.0000 (251)
Total energy cost			375.4872 (255)

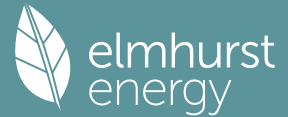
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1302 (257)
SAP value		81.6790
SAP rating (Section 12)		82 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	986.3602	0.1554	153.2369 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1105.5484	0.1416	156.5215 (264)
Space and water heating			309.7585 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	185.1513	0.1443	26.7231 (268)
Total CO2, kg/year			336.4815 (272)
CO2 emissions per m2			4.5100 (273)
EI value			96.2301
EI rating			96 (274)
EI band			A

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1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	189.8570 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.2107 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4607 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3916 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.4699	0.4405	0.4307	0.3818	0.3818	0.3524	0.3622	0.3426	0.3622	0.3916	0.4014	0.4307 (22b)
Effective ac	0.6104	0.5970	0.5928	0.5729	0.5729	0.5621	0.5656	0.5587	0.5656	0.5767	0.5805	0.5928 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			8.2000	1.1450	9.3893		(27)
French Doors			4.6000	1.1450	5.2672		(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000 (28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000 (29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000 (30)
Total net area of external elements Aum(A, m2)			164.2000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.5715		(33)
Main dwelling							
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000 (32)
Internal Wall			140.0000			9.0000	1260.0000 (32c)
Internal Floor			37.3000			18.0000	671.4000 (32d)
Internal Ceiling			37.3000			9.0000	335.7000 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7472.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.1729 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.1440	1.8576
E3 Sill	9.7000	0.0480	0.4656
E4 Jamb	25.2000	0.0640	1.6128
E5 Ground floor (normal)	17.6000	0.0510	0.8976
E6 Intermediate floor within a dwelling	17.6000	0.1300	2.2880
E10 Eaves (insulation at ceiling level)	17.6000	0.0750	1.3200
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	0.0000	0.0620	0.0000
E16 Corner (normal)	10.2000	0.0620	0.6324
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.7972 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		49.3687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.2434	37.4058	37.1386	35.8927	35.8927	35.2172	35.4364	35.0041	35.4364	36.1299	36.3731	37.1386 (38)
Heat transfer coeff	87.6121	86.7745	86.5073	85.2614	85.2614	84.5859	84.8051	84.3728	84.8051	85.4986	85.7418	86.5073 (39)
Average = Sum(39)m / 12 =												85.6444

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1744	1.1632	1.1596	1.1429	1.1429	1.1339	1.1368	1.1310	1.1368	1.1461	1.1494	1.1596 (40)
HLP (average)												1.1480
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3524 (42)
Hot water usage for mixer showers												
71.6201	70.5438	68.9754	65.9745	63.7600	61.2904	59.8866	61.4431	63.1494	65.8010	68.8663	71.3457 (42a)	
Hot water usage for baths												
27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071 (42b)	
Hot water usage for other uses												
38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213 (42c)	
Average daily hot water use (litres/day)												126.7294 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	137.8415	134.9487	131.3971	125.9278	121.5112	116.7530	114.8737	118.4094	122.1455	127.1473	132.7029	137.4741 (44)
Energy content	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (45)
Energy content (annual)												Total = Sum(45)m = 2104.9642
Distribution loss (46)m = 0.15 x (45)m												
32.7461	28.8248	30.2929	25.8583	24.5366	21.5342	20.8395	21.9923	22.5926	25.8807	28.3590	32.2877 (46)	
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (64)
												Total per year (kWh/year) = Sum(64)m = 2104.9642 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month												
72.5872	63.8949	67.1492	57.3193	54.3895	47.7342	46.1941	48.7497	50.0804	57.3688	62.8623	71.5710 (65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
26.2101	23.2796	18.9322	14.3329	10.7140	9.0452	9.7737	12.7042	17.0516	21.6509	25.2698	26.9385	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
310.1297	313.3478	305.2381	287.9736	266.1801	245.6974	232.0136	228.7954	236.9051	254.1697	275.9632	296.4459	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	(71)
Water heating gains (Table 5)												
97.5634	95.0817	90.2543	79.6101	73.1041	66.2975	62.0889	65.5237	69.5560	77.1086	87.3088	96.1976	(72)
Total internal gains	535.4189	533.2249	515.9405	483.4324	451.5141	419.5558	402.3920	405.5392	422.0285	454.4450	490.0575	521.0979 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				4.1000	12.7054		0.6300		0.0000		0.7700		25.2699 (74)
South				3.3000	53.5774		0.6300		0.0000		0.7700		85.7682 (78)
West				0.8000	23.7288		0.6300		0.0000		0.7700		9.2087 (80)
South				4.6000	53.5774		0.6300		0.0000		0.7700		119.5557 (78)
Solar gains	239.8025	357.4104	477.9284	617.6774	666.0748	708.8538	674.5275	622.1056	550.8340	419.1034	288.6721	199.4000	(83)
Total gains	775.2214	890.6353	993.8688	1101.1098	1117.5889	1128.4096	1076.9195	1027.6447	972.8625	873.5484	778.7296	720.4979	(84)

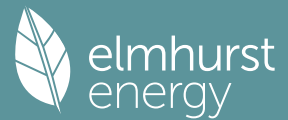
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.6931	23.9218	23.9957	24.3464	24.3464	24.5408	24.4774	24.6028	24.4774	24.2788	24.2100	23.9957
alpha	2.5795	2.5948	2.5997	2.6231	2.6231	2.6361	2.6318	2.6402	2.6318	2.6186	2.6140	2.5997
util living area	0.8898	0.8516	0.7870	0.6808	0.5514	0.3940	0.2761	0.2797	0.4730	0.6888	0.8354	0.9006 (86)
MIT	19.4354	19.6686	20.0244	20.4093	20.6780	20.8239	20.8672	20.8677	20.7835	20.4865	19.9498	19.4168 (87)
Th 2	19.9405	19.9496	19.9524	19.9659	19.9659	19.9733	19.9709	19.9756	19.9709	19.9634	19.9607	19.9524 (88)
util rest of house	0.8753	0.8333	0.7614	0.6444	0.5000	0.3291	0.2000	0.2008	0.4048	0.6433	0.8116	0.8871 (89)
MIT 2	18.1455	18.4370	18.8712	19.3345	19.6338	19.7835	19.8148	19.8202	19.7483	19.4329	18.7986	18.1327 (90)
Living area fraction												FLA = Living area / (4) = 0.3164 (91)
MIT	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8524	0.8105	0.7417	0.6333	0.4999	0.3382	0.2133	0.2147	0.4120	0.6338	0.7903	0.8648 (94)

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Useful gains	660.7601	721.8893	737.1409	697.2940	558.6775	381.6359	229.7564	220.5855	400.8529	553.6521	615.4349	623.0718	(95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Heat loss rate W	1187.4549	1165.0911	1049.8573	867.4960	627.8745	398.6194	233.0189	223.7233	430.4519	689.6491	948.5449	1153.9174	(97)
Space heating kWh	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491	(98a)
Space heating requirement - total per year (kWh/year)												1832.3516	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1832.3516	
Space heating per m2												24.5624	(99)

(98c) / (4) =

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													219.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491	(98)	
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)	
Space heating fuel (main heating system)	178.6872	135.8101	106.0926	55.8803	23.4759	0.0000	0.0000	0.0000	0.0000	46.1385	109.3658	180.0954	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513	(64)	
Efficiency of water heater													190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)	
Fuel for water heating, kWh/month	114.6572	100.9271	106.0675	90.5404	85.9125	75.3999	72.9673	77.0040	79.1059	90.6185	99.2960	113.0521	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	22.9415	18.4046	16.5713	12.1408	9.3779	7.6618	8.5548	11.1199	14.4437	18.9509	21.4050	23.5792	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													835.5456	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													190.4000	
Water heating fuel used													1105.5484	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													185.1513	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
FV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													2126.2454	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	835.5456	26.0600	217.7432	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1105.5484	26.0600	288.1059	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	185.1513	26.0600	48.2504	(250)
Additional standing charges			0.0000	(251)
Total energy cost			554.0995	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
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	kWh/year	kg CO ₂ /kWh	kg CO ₂ /year
Space heating - main system 1	835.5456	0.1560	130.3221 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1105.5484	0.1416	156.5215 (264)
Space and water heating			286.8436 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	185.1513	0.1443	26.7231 (268)
Total CO ₂ , kg/year			313.5667 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	835.5456	1.5774	1318.0181 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1105.5484	1.5235	1684.3455 (278)
Space and water heating			3002.3636 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	185.1513	1.5338	283.9913 (282)
Total Primary energy kWh/year			3286.3549 (286)

SAP 10 EPC IMPROVEMENTS

DB0103

Current energy efficiency rating: B 82
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable

Recommended measures:	SAP change	Cost change	CO ₂ change
N Solar water heating	+ 1.8	-£ 72	-35 kg (11.1%)
U Solar photovoltaic panels	+ 9.0	-£ 285	-248 kg (88.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£72	0.47 kg/m ²	B 84 A 97
Solar photovoltaic panels	£285	3.32 kg/m ²	A 93 A 99
Total Savings	£358	3.78 kg/m ²	

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£554	£482	£72
Space heating	£218	£239	-£21
Water heating	£288	£195	£93
Lighting	£48	£48	£0
Generated (PV)	-£0	-£285	£285
Total cost of fuels	£554	£197	£357
Total cost of uses	£554	£197	£357
Delivered energy	29 kWh/m ²	-1 kWh/m ²	30 kWh/m ²
Carbon dioxide emissions	0.3 tonnes	0.0 tonnes	0.3 tonnes
CO ₂ emissions per m ²	4 kg/m ²	0 kg/m ²	4 kg/m ²
Primary energy	44 kWh/m ²	15 kWh/m ²	29 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

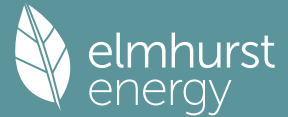
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 189.8570 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)

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Number of flues attached to solid fuel boiler
Number of flues attached to other heater
Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
4 * 10 = 40.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.2107 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.4607 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3916 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4993	0.4895	0.4797	0.4307	0.4210	0.3720	0.3720	0.3622	0.3916	0.4210	0.4405	0.4601 (22b)
Effective ac	0.6246	0.6198	0.6151	0.5928	0.5886	0.5692	0.5692	0.5656	0.5767	0.5886	0.5970	0.6059 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			8.2000	1.1450	9.3893		(27)
French Doors			4.6000	1.1450	5.2672		(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000 (28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000 (29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000 (30)
Total net area of external elements Aum(A, m2)			164.2000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5715		(33)
Main dwelling							
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000 (32)
Internal Wall			140.0000			9.0000	1260.0000 (32c)
Internal Floor			37.3000			18.0000	671.4000 (32d)
Internal Ceiling			37.3000			9.0000	335.7000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 7472.9000 (34)
100.1729 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	12.9000	0.1440	1.8576
E2 Other lintels (including other steel lintels)	9.7000	0.0480	0.4656
E3 Sill	25.2000	0.0640	1.6128
E4 Jamb	17.6000	0.0510	0.8976
E5 Ground floor (normal)	17.6000	0.1300	2.2880
E6 Intermediate floor within a dwelling	17.6000	0.0750	1.3200
E10 Eaves (insulation at ceiling level)	0.0000	0.0620	0.0000
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	10.2000	0.0620	0.6324
E16 Corner (normal)	0.0000	0.2400	0.0000
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.3687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	39.1351	38.8318	38.5346	37.1386	36.8774	35.6615	35.6615	35.4364	36.1299	36.8774	37.4058	37.9582 (38)
Heat transfer coeff	88.5038	88.2005	87.9033	86.5073	86.2461	85.0302	85.0302	84.8051	85.4986	86.2461	86.7745	87.3269 (39)
Average = Sum(39)m / 12 =												86.5061

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1864	1.1823	1.1783	1.1596	1.1561	1.1398	1.1398	1.1368	1.1461	1.1561	1.1632	1.1706 (40)
HLP (average)												1.1596
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3524 (42)
Hot water usage for mixer showers 71.6201 70.5438 68.9754 65.9745 63.7600 61.2904 59.8866 61.4431 63.1494 65.8010 68.8663 71.3457 (42a)
Hot water usage for baths 27.5001 27.0917 26.5166 25.4561 24.6621 23.7816 23.3060 23.8771 24.4989 25.4411 26.5234 27.4071 (42b)
Hot water usage for other uses 38.7213 37.3133 35.9052 34.4972 33.0891 31.6811 31.6811 33.0891 34.4972 35.9052 37.3133 38.7213 (42c)
Average daily hot water use (litres/day) 126.7294 (43)
Daily hot water use
Jan 137.8415 Feb 134.9487 Mar 131.3971 Apr 125.9278 May 121.5112 Jun 116.7530 Jul 114.8737 Aug 118.4094 Sep 122.1455 Oct 127.1473 Nov 132.7029 Dec 137.4741 (44)
Energy conte 218.3072 192.1652 201.9525 172.3889 163.5774 143.5614 138.9298 146.6155 150.6176 172.5377 189.0597 215.2513 (45)
Energy content (annual)
Distribution loss (46)m = 0.15 x (45)m
32.7461 28.8248 30.2929 25.8583 24.5366 21.5342 20.8395 21.9923 22.5926 25.8807 28.3590 32.2877 (46)
Water storage loss:
Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												
Zero-loss collector efficiency												0.8000 (H1)
Collector linear heat loss coefficient												0.8000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector loop efficiency												0.0000 (H4)
Incidence angle modifier												0.9000 (H5)
Overshading factor												1.0000 (H6)
Overall heat loss coefficient of system												0.8000 (H8)
Heat loss coefficient of collector loop												6.5000 (H10)
Dedicated solar storage volume												3.9667 (H11)
Effective solar volume												75.0000 (H12)
Reference volume												75.0000 (H14)
Storage tank correction coefficient												225.0000 (H15)
Heat delivered to hot water												1.3161 (H16)
Heat delivered to space heating												585.1787 (H24)
Solar input												0.0000 (H29)
Solar input	-0.0000	-16.2693	-56.5667	-76.2103	-97.7898	-89.1038	-87.6955	-78.1221	-55.0327	-28.3885	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	218.3072	175.8959	145.3858	96.1785	65.7876	54.4577	51.2343	68.4935	95.5849	144.1492	189.0597	215.2513 (64)
								Total per year (kWh/year) = Sum(64)m =				1519.7855 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000 (64a)
Heat gains from water heating, kWh/month	72.5872	63.8949	67.1492	57.3193	54.3895	47.7342	46.1941	48.7497	50.0804	57.3688	62.8623	71.5710 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	26.2101	23.2796	18.9322	14.3329	10.7140	9.0452	9.7737	12.7042	17.0516	21.6509	25.2698	26.9385 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	310.1297	313.3478	305.2381	287.9736	266.1801	245.6974	232.0136	228.7954	236.9051	254.1697	275.9632	296.4459 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)												
	97.5634	95.0817	90.2543	79.6101	73.1041	66.2975	62.0889	65.5237	69.5560	77.1086	87.3088	96.1976 (72)
Total internal gains	535.4189	533.2249	515.9405	483.4324	451.5141	419.5558	402.3920	405.5392	422.0285	454.4450	490.0575	521.0979 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North						4.1000	10.6334	0.6300	0.0000	0.7700		21.1489 (74)
South						3.3000	46.7521	0.6300	0.0000	0.7700		74.8421 (78)
West						0.8000	19.6403	0.6300	0.0000	0.7700		7.6220 (80)
South						4.6000	46.7521	0.6300	0.0000	0.7700		104.3254 (78)
Solar gains	207.9383	348.7569	467.0106	568.5761	632.7111	627.6631	605.2315	556.5637	501.5865	382.2948	247.9681	178.7159 (83)
Total gains	743.3572	881.9819	982.9511	1052.0085	1084.2252	1047.2190	1007.6235	962.1029	923.6150	836.7398	738.0256	699.8138 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.4544	23.5351	23.6146	23.9957	24.0684	24.4126	24.4126	24.4774	24.2788	24.0684	23.9218	23.7705
alpha	2.5636	2.5690	2.5743	2.5997	2.6046	2.6275	2.6275	2.6318	2.6186	2.6046	2.5948	2.5847
util living area	0.9066	0.8636	0.8062	0.7204	0.6073	0.4704	0.3535	0.3822	0.5498	0.7472	0.8691	0.9170 (86)
MIT	19.2543	19.5475	19.9034	20.2926	20.5889	20.7774	20.8467	20.8376	20.7147	20.3271	19.7307	19.2032 (87)
Th 2	19.9309	19.9342	19.9374	19.9524	19.9553	19.9684	19.9684	19.9709	19.9634	19.9553	19.9496	19.9436 (88)
util rest of house												
	0.8943	0.8468	0.7828	0.6869	0.5601	0.4067	0.2767	0.3043	0.4865	0.7093	0.8501	0.9059 (89)
MIT 2	17.9128	18.2761	18.7132	19.1897	19.5298	19.7384	19.7989	19.7951	19.6766	19.2450	18.5226	17.8585 (90)
Living area fraction												
	18.3372	18.6783	19.0897	19.5386	19.8648	20.0671	20.1304	20.1249	20.0050	19.5873	18.9048	0.3164 (91)
MIT	18.3372	18.6783	19.0897	19.5386	19.8648	20.0671	20.1304	20.1249	20.0050	19.5873	18.9048	18.2839 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3372	18.6783	19.0897	19.5386	19.8648	20.0671	20.1304	20.1249	20.0050	19.5873	18.9048	18.2839 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8718	0.8234	0.7615	0.6724	0.5557	0.4131	0.2891	0.3164	0.4892	0.6944	0.8275	0.8843 (94)
Useful gains	648.0426	726.1962	748.4882	707.3528	602.5208	432.5679	291.3297	304.3713	451.8389	581.0392	610.7425	618.8635 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1242.3444	1215.2563	1106.6787	920.3198	704.1851	464.8656	300.1884	315.8895	504.8716	775.1218	1024.3552	1229.9016 (97)
Space heating kWh	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98a)
Space heating requirement - total per year (kWh/year)												
Solar heating kWh												2163.0879

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Solar heating contribution - total per year (kWh/year)	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Space heating kWh	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2163.0879
Space heating per m2										(98c) / (4) =		28.9958 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	201.6236	149.8624	121.5202	69.9207	34.4908	0.0000	0.0000	0.0000	0.0000	65.8447	135.7962	207.3016 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	218.3072	175.8959	145.3858	96.1785	65.7876	54.4577	51.2343	68.4935	95.5849	144.1492	189.0597	215.2513 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	114.6572	92.3823	76.3581	50.5139	34.5523	28.6017	26.9088	35.9735	50.2021	75.7086	99.2960	113.0521 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	22.9415	18.4046	16.5713	12.1408	9.3779	7.6618	8.5548	11.1199	14.4437	18.9509	21.4050	23.5792 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-37.4685	-55.2043	-81.2634	-91.0982	-95.1388	-83.8465	-82.5205	-78.6295	-70.6796	-62.1572	-41.7099	-32.1163 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-12.6180	-28.3757	-61.0828	-99.6739	-140.5440	-147.8672	-146.1311	-121.1445	-85.7835	-44.6886	-17.6999	-9.7976 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												986.3602 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												798.2067 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												185.1513 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1727.2394 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												322.4788 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	986.3602	16.4900	162.6508 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	798.2067	16.4900	131.6243 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	185.1513	16.4900	30.5315 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-811.8326	16.4900	-133.8712
PV Unit electricity exported	-915.4068	5.5900	-51.1712
Total			-185.0424 (252)
Total energy cost			152.9561 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4604 (257)

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SAP value
SAP rating (Section 12)
SAP band

92.5369
93 (258)
A

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	986.3602	0.1554	153.2369	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	798.2067	0.1469	117.2278	(264)
Space and water heating			270.4647	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	185.1513	0.1443	26.7231	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-811.8326	0.1350	-109.5960	
PV Unit electricity exported	-915.4068	0.1233	-112.8433	
Total			-222.4393	(269)
Total CO2, kg/year			85.8455	(272)
CO2 emissions per m2			1.1500	(273)
EI value			99.0382	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)	
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 189.8570 (5)	

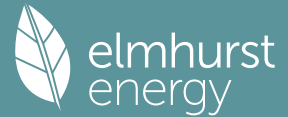
2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2107 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000 (17)	
Infiltration rate		0.4607 (18)	
Number of sides sheltered		2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3916 (21)	
Wind speed	Jan 4.8000 Feb 4.5000 Mar 4.4000 Apr 3.9000 May 3.9000 Jun 3.6000 Jul 3.7000 Aug 3.5000 Sep 3.7000 Oct 4.0000 Nov 4.1000 Dec 4.4000 (22)		
Wind factor	1.2000 1.1250 1.1000 0.9750 0.9750 0.9000 0.9250 0.8750 0.9250 1.0000 1.0250 1.1000 (22a)		
Adj infilt rate	0.4699 0.4405 0.4307 0.3818 0.3818 0.3524 0.3622 0.3426 0.3622 0.3916 0.4014 0.4307 (22b)		
Effective ac	0.6104 0.5970 0.5928 0.5729 0.5729 0.5621 0.5656 0.5587 0.5656 0.5767 0.5805 0.5928 (25)		

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1000	0.9000	1.8900			(26a)
Windows			8.2000	1.1450	9.3893			(27)
French Doors			4.6000	1.1450	5.2672			(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000	(28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000	(29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000	(30)
Total net area of external elements Aum (A, m2)			164.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5715			(33)
Main dwelling								
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000	(32)
Internal Wall			140.0000			9.0000	1260.0000	(32c)
Internal Floor			37.3000			18.0000	671.4000	(32d)
Internal Ceiling			37.3000			9.0000	335.7000	(32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7472.9000	(34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

100.1729 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	12.9000	0.1440	1.8576
E2 Other lintels (including other steel lintels)	9.7000	0.0480	0.4656
E3 Sill	25.2000	0.0640	1.6128
E4 Jamb	17.6000	0.0510	0.8976
E5 Ground floor (normal)	17.6000	0.1300	2.2880
E6 Intermediate floor within a dwelling	17.6000	0.0750	1.3200
E10 Eaves (insulation at ceiling level)	0.0000	0.0620	0.0000
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	10.2000	0.0620	0.6324
E16 Corner (normal)	0.0000	0.2400	0.0000
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 49.3687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.2434	37.4058	37.1386	35.8927	35.8927	35.2172	35.4364	35.0041	35.4364	36.1299	36.3731	37.1386	(38)
Heat transfer coeff	87.6121	86.7745	86.5073	85.2614	85.2614	84.5859	84.8051	84.3728	84.8051	85.4986	85.7418	86.5073	(39)
Average = Sum(39)m / 12 =												85.6444	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1744	1.1632	1.1596	1.1429	1.1429	1.1339	1.1368	1.1310	1.1368	1.1461	1.1494	1.1596	(40)
HLP (average)												1.1480	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.3524 (42)

Hot water usage for mixer showers

71.6201 70.5438 68.9754 65.9745 63.7600 61.2904 59.8866 61.4431 63.1494 65.8010 68.8663 71.3457 (42a)

Hot water usage for baths

27.5001 27.0917 26.5166 25.4561 24.6621 23.7816 23.3060 23.8771 24.4989 25.4411 26.5234 27.4071 (42b)

Hot water usage for other uses

38.7213 37.3133 35.9052 34.4972 33.0891 31.6811 31.6811 33.0891 34.4972 35.9052 37.3133 38.7213 (42c)

Average daily hot water use (litres/day)

126.7294 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.8415	134.9487	131.3971	125.9278	121.5112	116.7530	114.8737	118.4094	122.1455	127.1473	132.7029	137.4741	(44)
Energy conte	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
32.7461 28.8248 30.2929 25.8583 24.5366 21.5342 20.8395 21.9923 22.5926 25.8807 28.3590 32.2877 (46)													

Water storage loss:

Total storage loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)

If cylinder contains dedicated solar storage

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)

Primary loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Combi loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month

218.3072 192.1652 201.9525 172.3889 163.5774 143.5614 138.9298 146.6155 150.6176 172.5377 189.0597 215.2513 (62)

WWHRS

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

PV diverter

-0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Aperture area of solar collector

3.0000 (H1)

Zero-loss collector efficiency

0.8000 (H2)

Collector linear heat loss coefficient

1.8000 (H3)

Collector 2nd order heat loss coefficient

0.0000 (H4)

Collector loop efficiency

0.9000 (H5)

Incidence angle modifier

1.0000 (H6)

Overshading factor

0.8000 (H8)

Overall heat loss coefficient of system

6.5000 (H10)

Heat loss coefficient of collector loop

3.9667 (H11)

Dedicated solar storage volume

75.0000 (H12)

Effective solar volume

75.0000 (H14)

Reference volume

225.0000 (H15)

Storage tank correction coefficient

1.3161 (H16)

Heat delivered to hot water

680.7527 (H24)

Heat delivered to space heating

0.0000 (H29)

Solar input

680.7527

Solar input

-1.0063 -19.8383 -61.9997 -87.3255 -105.6509 -102.3216 -99.4941 -91.4019 -66.1835 -38.4367 -7.0941 -0.0000 (63c)

FGHRS

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h

217.3009 172.3269 139.9528 85.0634 57.9265 41.2398 39.4356 55.2136 84.4341 134.1010 181.9656 215.2513 (64)

Total per year (kWh/year) = Sum(64)m = 1424.2115 (64)

Electric shower(s)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

72.5872 63.8949 67.1492 57.3193 54.3895 47.7342 46.1941 48.7497 50.0804 57.3688 62.8623 71.5710 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

(66)m 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

26.2101 23.2796 18.9322 14.3329 10.7140 9.0452 9.7737 12.7042 17.0516 21.6509 25.2698 26.9385 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

310.1297 313.3478 305.2381 287.9736 266.1801 245.6974 232.0136 228.7954 236.9051 254.1697 275.9632 296.4459 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 (69)

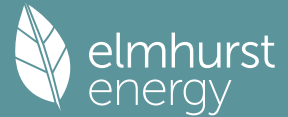
Pumps, fans

3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

-94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 (71)

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Water heating gains (Table 5)	97.5634	95.0817	90.2543	79.6101	73.1041	66.2975	62.0889	65.5237	69.5560	77.1086	87.3088	96.1976 (72)
Total internal gains	535.4189	533.2249	515.9405	483.4324	451.5141	419.5558	402.3920	405.5392	422.0285	454.4450	490.0575	521.0979 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.1000	12.7054	0.6300	0.0000	0.7700	25.2699 (74)			
South				3.3000	53.5774	0.6300	0.0000	0.7700	85.7682 (78)			
West				0.8000	23.7288	0.6300	0.0000	0.7700	9.2087 (80)			
South				4.6000	53.5774	0.6300	0.0000	0.7700	119.5557 (78)			
Solar gains	239.8025	357.4104	477.9284	617.6774	666.0748	708.8538	674.5275	622.1056	550.8340	419.1034	288.6721	199.4000 (83)
Total gains	775.2214	890.6353	993.8688	1101.1098	1117.5889	1128.4096	1076.9195	1027.6447	972.8625	873.5484	778.7296	720.4979 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.6931	23.9218	23.9957	24.3464	24.3464	24.5408	24.4774	24.6028	24.4774	24.2788	24.2100	23.9957
alpha	2.5795	2.5948	2.5997	2.6231	2.6231	2.6361	2.6318	2.6402	2.6318	2.6186	2.6140	2.5997
util living area	0.8898	0.8516	0.7870	0.6808	0.5514	0.3940	0.2761	0.2797	0.4730	0.6888	0.8354	0.9006 (86)
MIT	19.4354	19.6686	20.0244	20.4093	20.6780	20.8239	20.8672	20.8677	20.7835	20.4865	19.9498	19.4168 (87)
Th 2	19.9405	19.9496	19.9524	19.9659	19.9659	19.9733	19.9709	19.9756	19.9709	19.9634	19.9607	19.9524 (88)
util rest of house	0.8753	0.8333	0.7614	0.6444	0.5000	0.3291	0.2000	0.2008	0.4048	0.6433	0.8116	0.8871 (89)
MIT 2	18.1455	18.4370	18.8712	19.3345	19.6338	19.7835	19.8148	19.8202	19.7483	19.4329	18.7986	18.1327 (90)
Living area fraction	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (92)
MIT	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (93)
Temperature adjustment												0.0000
adjusted MIT	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8524	0.8105	0.7417	0.6333	0.4999	0.3382	0.2133	0.2147	0.4120	0.6338	0.7903	0.8648 (94)
Useful gains	660.7601	721.8893	737.1409	697.2940	558.6775	381.6359	229.7564	220.5855	400.8529	553.6521	615.4349	623.0718 (95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Heat loss rate W	1187.4549	1165.0911	1049.8573	867.4960	627.8745	398.6194	233.0189	223.7233	430.4519	689.6491	948.5449	1153.9174 (97)
Space heating kWh	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491 (98a)
Space heating requirement - total per year (kWh/year)												1832.3516
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1832.3516
Space heating per m ²										(98c) / (4) =		24.5624 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	178.6872	135.8101	106.0926	55.8803	23.4759	0.0000	0.0000	0.0000	0.0000	46.1385	109.3658	180.0954 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	217.3009	172.3269	139.9528	85.0634	57.9265	41.2398	39.4356	55.2136	84.4341	134.1010	181.9656	215.2513 (64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	114.1286	90.5078	73.5046	44.6761	30.4236	21.6596	20.7120	28.9987	44.3456	70.4312	95.5702	113.0521 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	22.9415	18.4046	16.5713	12.1408	9.3779	7.6618	8.5548	11.1199	14.4437	18.9509	21.4050	23.5792 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-43.0168	-57.2203	-83.3294	-94.9471	-96.0484	-87.6566	-85.9451	-82.7354	-75.0550	-66.4432	-47.6836	-35.8876 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

10a. Fuel costs - using BEDF prices (568)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	835.5456	1.5774	1318.0181	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	748.0102	1.5477	1157.6725	(278)
Space and water heating			2475.6906	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	185.1513	1.5338	283.9913	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.9683	1.4998	-1283.7590	
PV Unit electricity exported	-1071.6419	0.4512	-483.5687	
Total			-1767.3277	(283)
Total Primary energy kWh/year			1113.3781	(286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 07 Apr 2025 15:04:11

Project Information			
Assessed By	Joe Solti	Building Type	House, Semi-detached
OCDEA Registration	EES/003578	Assessment Date	2025-04-07

Dwelling Details			
Assessment Type	As designed	Total Floor Area	75 m ²
Site Reference	DB0104	Plot Reference	DB0104
Address	R/O Karenza Plot 4 Hook Lane, Aldingbourne		

Client Details	
Name	.
Company	.
Address	., ., .

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	11.78 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	4.61 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	61.54 kWh _{PE} /m ²		
Dwelling primary energy	48.26 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	36.6 kWh/m ²		
Dwelling fabric energy efficiency	34.6 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	Ground Floor (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.16	Windows (N) (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	74.7	0.18	
Party wall: Party Wall (1)	36.4	0 (!)	
Ground floor: Ground Floor, Ground Floor	37.3	0.12	
Exposed roof: Roof (1)	37.3	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front Door, Front Door	2.1	North	N/A	0.9 (!)
Windows (N), Windows	4.1	North	1.0	1.2
Windows (S), Windows	3.3	South	1.0	1.2
Windows (E), Windows	0.8	East	1.0	1.2
French Doors, French Doors	4.6	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.144	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.048	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.064	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.051	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.13	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.062	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.062	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.062	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
External wall	E20: Exposed floor (normal)	SAP table default	0.32	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.044	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.059	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.118	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	5 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

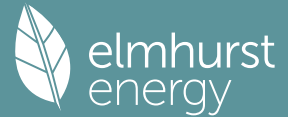
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	219.3%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:		
	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	DB0104				Issued on Date	07/04/2025
Assessment Reference	DB0104	Prop Type Ref		New Dwelling		
Property	Plot 4, R/O Karenza, Hook Lane, Aldingbourne, West Sussex					
SAP Rating	82 B	DER	4.61	TER	11.78	
Environmental	96 A	% DER < TER				60.87
CO ₂ Emissions (t/year)	0.31	DFEE	34.56	TFEE	36.62	
Compliance Check	See BREL	% DFEE < TFEE				5.61
% DPER < TPER	21.57	DPER	48.26	TPER	61.54	
Assessor Details	Mr. Joe Solti				Assessor ID	5122-0001
Client	SBC Limited, .					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 189.8570 (5)

2. Ventilation rate

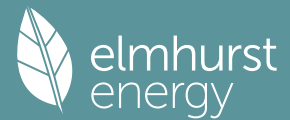
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.2107 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4607 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3916 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4993	0.4895	0.4797	0.4307	0.4210	0.3720	0.3720	0.3622	0.3916	0.4210	0.4405	0.4601 (22b)
Effective ac	0.6246	0.6198	0.6151	0.5928	0.5886	0.5692	0.5692	0.5656	0.5767	0.5886	0.5970	0.6059 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			8.2000	1.1450	9.3893		(27)
French Doors			4.6000	1.1450	5.2672		(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000 (28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000 (29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000 (30)
Total net area of external elements Aum(A, m ²)			164.2000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5715		(33)
Main dwelling							
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000 (32)
Internal Wall			140.0000			9.0000	1260.0000 (32c)
Internal Floor			37.3000			18.0000	671.4000 (32d)
Internal Ceiling			37.3000			9.0000	335.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7472.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.1729 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				12.9000	0.1440	1.8576	

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E3 Sill	9.7000	0.0480	0.4656
E4 Jamb	25.2000	0.0640	1.6128
E5 Ground floor (normal)	17.6000	0.0510	0.8976
E6 Intermediate floor within a dwelling	17.6000	0.1300	2.2880
E10 Eaves (insulation at ceiling level)	17.6000	0.0750	1.3200
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	0.0000	0.0620	0.0000
E16 Corner (normal)	10.2000	0.0620	0.6324
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.7972 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	49.3687 (37)

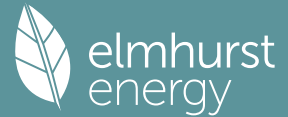
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.1351	38.8318	38.5346	37.1386	36.8774	35.6615	35.6615	35.4364	36.1299	36.8774	37.4058	37.9582 (38)
Average = Sum(39)m / 12 =	88.5038	88.2005	87.9033	86.5073	86.2461	85.0302	85.0302	84.8051	85.4986	86.2461	86.7745	87.3269 (39)
												86.5061
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1864	1.1823	1.1783	1.1596	1.1561	1.1398	1.1398	1.1368	1.1461	1.1561	1.1632	1.1706 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.3524 (42)
Hot water usage for mixer showers												
	71.6201	70.5438	68.9754	65.9745	63.7600	61.2904	59.8866	61.4431	63.1494	65.8010	68.8663	71.3457 (42a)
Hot water usage for baths												
	27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071 (42b)
Hot water usage for other uses												
	38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213 (42c)
Average daily hot water use (litres/day)												126.7294 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	137.8415	134.9487	131.3971	125.9278	121.5112	116.7530	114.8737	118.4094	122.1455	127.1473	132.7029	137.4741 (44)
Energy conte	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (45)
Energy content (annual)										Total = Sum(45)m =		2104.9642
Distribution loss (46)m = 0.15 x (45)m												
	32.7461	28.8248	30.2929	25.8583	24.5366	21.5342	20.8395	21.9923	22.5926	25.8807	28.3590	32.2877 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2104.9642 (64)
Electric shower(s)												2105 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	72.5872	63.8949	67.1492	57.3193	54.3895	47.7342	46.1941	48.7497	50.0804	57.3688	62.8623	71.5710 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	107.9127	119.4748	107.9127	111.5098	107.9127	111.5098	107.9127	107.9127	111.5098	107.9127	111.5098	107.9127 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)												
	97.5634	95.0817	90.2543	79.6101	73.1041	66.2975	62.0889	65.5237	69.5560	77.1086	87.3088	96.1976 (72)
Total internal gains	474.5495	485.7861	463.9632	445.3488	420.6441	400.7111	383.7373	385.0160	398.0789	416.6016	445.0005	464.0157 (73)

6. Solar gains							
[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.1000	10.6334	0.6300	0.0000	0.7700	21.1489 (74)	
East	0.8000	19.6403	0.6300	0.0000	0.7700	7.6220 (76)	
South	3.3000	46.7521	0.6300	0.0000	0.7700	74.8421 (78)	
South	4.6000	46.7521	0.6300	0.0000	0.7700	104.3254 (78)	

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Solar gains	207.9383	348.7569	467.0106	568.5761	632.7111	627.6631	605.2315	556.5637	501.5865	382.2948	247.9681	178.7159 (83)
Total gains	682.4879	834.5431	930.9737	1013.9249	1053.3552	1028.3742	988.9688	941.5797	899.6653	798.8964	692.9686	642.7316 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.4544	23.5351	23.6146	23.9957	24.0684	24.4126	24.4126	24.4774	24.2788	24.0684	23.9218	23.7705
alpha	2.5636	2.5690	2.5743	2.5997	2.6046	2.6275	2.6275	2.6318	2.6186	2.6046	2.5948	2.5847
util living area	0.9207	0.8762	0.8220	0.7336	0.6187	0.4772	0.3595	0.3894	0.5602	0.7630	0.8830	0.9298 (86)
MIT	19.1622	19.4858	19.8482	20.2639	20.5751	20.7737	20.8452	20.8355	20.7069	20.2951	19.6706	19.1135 (87)
Th 2	19.9309	19.9342	19.9374	19.9524	19.9553	19.9684	19.9684	19.9709	19.9634	19.9553	19.9496	19.9436 (88)
util rest of house	0.9099	0.8605	0.7997	0.7007	0.5715	0.4130	0.2816	0.3104	0.4966	0.7261	0.8655	0.9202 (89)
MIT 2	17.7992	18.2014	18.6483	19.1579	19.5160	19.7353	19.7980	19.7938	19.6698	19.2099	18.4503	17.7474 (90)
Living area fraction									fLA =	Living area / (4) =		0.3164 (91)
MIT	18.2304	18.6077	19.0279	19.5078	19.8511	20.0638	20.1293	20.1233	19.9979	19.5532	18.8363	18.1796 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2304	18.6077	19.0279	19.5078	19.8511	20.0638	20.1293	20.1233	19.9979	19.5532	18.8363	18.1796 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8884	0.8371	0.7777	0.6853	0.5665	0.4192	0.2941	0.3225	0.4988	0.7102	0.8430	0.8997 (94)
Useful gains	606.3294	698.5952	724.0262	694.8401	596.6912	431.1416	290.8686	303.6949	448.7612	567.3566	584.1624	578.2955 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1232.8906	1209.0297	1101.2435	917.6523	702.9982	464.5883	300.0978	315.7571	504.2582	772.1781	1018.4143	1220.7939 (97)
Space heating kWh	466.1615	343.0120	280.6497	160.4248	79.0924	0.0000	0.0000	0.0000	0.0000	152.3873	312.6614	478.0188 (98a)
Space heating requirement - total per year (kWh/year)												2272.4077
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	466.1615	343.0120	280.6497	160.4248	79.0924	0.0000	0.0000	0.0000	0.0000	152.3873	312.6614	478.0188 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2272.4077
Space heating per m2										(98c) / (4) =		30.4612 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	466.1615	343.0120	280.6497	160.4248	79.0924	0.0000	0.0000	0.0000	0.0000	152.3873	312.6614	478.0188 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	212.5679	156.4122	127.9752	73.1531	36.0658	0.0000	0.0000	0.0000	0.0000	69.4880	142.5725	217.9748 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	114.6572	100.9271	106.0675	90.5404	85.9125	75.3999	72.9673	77.0040	79.1059	90.6185	99.2960	113.0521 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (222)
Lighting	22.9415	18.4046	16.5713	12.1408	9.3779	7.6618	8.5548	11.1199	14.4437	18.9509	21.4050	23.5792 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1036.2096 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1105.5484 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

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Total electricity for the above, kWh/year 0.0000 (231)
Electricity for lighting (calculated in Appendix L) 185.1513 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2326.9094 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1036.2096	0.1554	160.9850 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1105.5484	0.1416	156.5215 (264)
Space and water heating			317.5066 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	185.1513	0.1443	26.7231 (268)
Total CO2, kg/year			344.2296 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6100 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1036.2096	1.5752	1632.1873 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1105.5484	1.5235	1684.3455 (278)
Space and water heating			3316.5328 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	185.1513	1.5338	283.9913 (282)
Total Primary energy kWh/year			3600.5241 (286)
Dwelling Primary energy Rate (DPER)			48.2600 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	189.8570 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1580 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4080 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3468 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4422	0.4335	0.4248	0.3815	0.3728	0.3295	0.3295	0.3208	0.3468	0.3728	0.3902	0.4075 (22b)
Effective ac	0.5978	0.5940	0.5902	0.5728	0.5695	0.5543	0.5543	0.5515	0.5601	0.5695	0.5761	0.5830 (25)

3. Heat losses and heat loss parameter

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Element			Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K				
Main dwelling													
TER Semi-glazed door					2.1000	1.0000	2.1000			(26a)			
TER Opening Type					12.8000	1.1450	14.6565			(27)			
Ground Floor					37.3000	0.1300	4.8490			(28a)			
Wall (cavity)	89.6000	14.9000			74.7000	0.1800	13.4460			(29a)			
Roof (loft)	37.3000				37.3000	0.1100	4.1030			(30)			
Total net area of external elements Aum(A, m2)					164.2000					(31)			
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		39.1545			(33)			
Main dwelling													
Party Wall					36.4000	0.0000	0.0000			(32)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K									100.1729	(35)			
List of Thermal Bridges													
K1 Element						Length	Psi-value		Total				
E2 Other lintels (including other steel lintels)						12.9000	0.0500		0.6450				
E3 Sill						9.7000	0.0500		0.4850				
E4 Jamb						25.2000	0.0500		1.2600				
E5 Ground floor (normal)						17.6000	0.1600		2.8160				
E6 Intermediate floor within a dwelling						17.6000	0.0000		0.0000				
E10 Eaves (insulation at ceiling level)						17.6000	0.0600		1.0560				
E12 Gable (insulation at ceiling level)						0.0000	0.0600		0.0000				
E13 Gable (insulation at rafter level)						0.0000	0.0800		0.0000				
E16 Corner (normal)						10.2000	0.0900		0.9180				
R1 Head of roof window						0.0000	0.0800		0.0000				
R2 Sill of roof window						0.0000	0.0600		0.0000				
R3 Jamb of roof window						0.0000	0.0800		0.0000				
E20 Exposed floor (normal)						0.0000	0.3200		0.0000				
E18 Party wall between dwellings						10.2000	0.0600		0.6120				
P1 Party wall - Ground floor						7.2000	0.0800		0.5760				
P4 Party wall - Roof (insulation at ceiling level)						7.2000	0.1200		0.8640				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									9.2320	(36)			
Point Thermal bridges								(36a) =	0.0000				
Total fabric heat loss								(33) + (36) + (36a) =	48.3865	(37)			
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 37.4516	Feb 37.2137	Mar 36.9806	Apr 35.8855	May 35.6807	Jun 34.7269	Jul 34.7269	Aug 34.5503	Sep 35.0943	Oct 35.6807	Nov 36.0951	Dec 36.5284	(38)
Heat transfer coeff	85.8381	85.6002	85.3671	84.2720	84.0672	83.1134	83.1134	82.9368	83.4808	84.0672	84.4816	84.9149	(39)
Average = Sum(39)m / 12 =												84.2711	
HLP	Jan 1.1506	Feb 1.1475	Mar 1.1443	Apr 1.1297	May 1.1269	Jun 1.1141	Jul 1.1141	Aug 1.1118	Sep 1.1190	Oct 1.1269	Nov 1.1325	Dec 1.1383	(40)
HLP (average)												1.1296	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

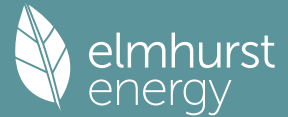
4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.3524 (42)
Hot water usage for mixer showers													
63.6623	62.7056	61.3115	58.6440	56.6756	54.4803	53.2325	54.6161	56.1328	58.4898	61.2145	63.4184	63.4184	(42a)
Hot water usage for baths													
27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071	27.4071	(42b)
Hot water usage for other uses													
38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213	38.7213	(42c)
Average daily hot water use (litres/day)													119.3926 (43)
Daily hot water use	Jan 129.8837	Feb 127.1105	Mar 123.7332	Apr 118.5973	May 114.4267	Jun 109.9430	Jul 108.2196	Aug 111.5823	Sep 115.1289	Oct 119.8361	Nov 125.0511	Dec 129.5468	(44)
Energy conte	205.7040	181.0037	190.1733	162.3538	154.0404	135.1877	130.8822	138.1623	141.9654	162.6164	178.1583	202.8390	(45)
Energy content (annual)										Total = Sum(45)m =		1983.0866	
Distribution loss (46)m = 0.15 x (45)m													
30.8556	27.1506	28.5260	24.3531	23.1061	20.2782	19.6323	20.7243	21.2948	24.3925	26.7237	30.4259	30.4259	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.3938 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7527 (55)
Total storage loss													
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	(56)
If cylinder contains dedicated solar storage													
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
252.2989	223.0894	236.7682	207.4456	200.6353	180.2795	177.4771	184.7572	187.0573	209.2113	223.2501	249.4339	249.4339	(62)
WWHRS	-29.1037	-25.7396	-26.9530	-22.3182	-20.7997	-17.7985	-16.6832	-17.7409	-18.4150	-21.7092	-24.5939	-28.5648	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	223.1952	197.3498	209.8152	185.1275	179.8355	162.4811	160.7939	167.0162	168.6423	187.5021	198.6562	220.8691	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2261.2841	(64)
Electric shower(s)												2261	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month													
105.6725	93.8523	100.5086	90.0561	88.4943	81.0234	80.7943	83.2149	83.2770	91.3459	95.3111	104.7199	104.7199	(65)

5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	Jan 117.6218	Feb 117.6218	Mar 117.6218	Apr 117.6218	May 117.6218	Jun 117.6218	Jul 117.6218	Aug 117.6218	Sep 117.6218	Oct 117.6218	Nov 117.6218	Dec 117.6218	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
107.9127	119.4748	107.9127	111.5098	107.9127	111.5098	107.9127	111.5098	107.9127	111.5098	107.9127	111.5098	107.9127	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188	198.6188	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													

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	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)	142.0330	139.6612	135.0921	125.0779	118.9440	112.5325	108.5944	111.8479	115.6625	122.7767	132.3765	140.7525 (72)
Total internal gains	519.0191	530.3656	508.8010	490.8166	466.4840	446.9461	430.2428	431.3402	444.1853	462.2697	490.0682	508.5706 (73)

6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	4.1000		10.6334		0.6300		0.7000		0.7700		13.3238 (74)	
East	0.8000		19.6403		0.6300		0.7000		0.7700		4.8019 (76)	
South	7.9000		46.7521		0.6300		0.7000		0.7700		112.8755 (78)	
Solar gains	131.0011	219.7169	294.2167	358.2030	398.6080	395.4278	381.2958	350.6351	315.9995	240.8457	156.2199	112.5910 (83)
Total gains	650.0203	750.0824	803.0177	849.0195	865.0920	842.3738	811.5387	781.9753	760.1848	703.1155	646.2881	621.1616 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.1828	24.2500	24.3162	24.6322	24.6922	24.9756	24.9756	25.0288	24.8657	24.6922	24.5711	24.4457
alpha	2.6122	2.6167	2.6211	2.6421	2.6461	2.6650	2.6650	2.6686	2.6577	2.6461	2.6381	2.6297
util living area	0.9265	0.8957	0.8572	0.7881	0.6881	0.5475	0.4194	0.4482	0.6200	0.7993	0.8950	0.9333 (86)
MIT	18.7307	19.0695	19.4966	20.0359	20.4864	20.8045	20.9298	20.9142	20.7109	20.1404	19.3629	18.6782 (87)
Th 2	19.9597	19.9623	19.9648	19.9767	19.9789	19.9893	19.9893	19.9912	19.9853	19.9789	19.9744	19.9697 (88)
util rest of house	0.9165	0.8820	0.8381	0.7589	0.6430	0.4804	0.3333	0.3624	0.5564	0.7659	0.8790	0.9242 (89)
MIT 2	17.3378	17.7607	18.2921	18.9563	19.4853	19.8359	19.9496	19.9399	19.7433	19.0960	18.1427	17.2782 (90)
Living area fraction									fLA = Living area / (4) =			0.3164 (91)
MIT	17.7784	18.1747	18.6731	19.2978	19.8020	20.1423	20.2597	20.2481	20.0494	19.4264	18.5288	17.7211 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7784	18.1747	18.6731	19.2978	19.8020	20.1423	20.2597	20.2481	20.0494	19.4264	18.5288	17.7211 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8890	0.8525	0.8095	0.7368	0.6345	0.4911	0.3572	0.3852	0.5608	0.7450	0.8507	0.8978 (94)
Useful gains	577.8613	639.4685	650.0173	625.5441	548.8750	413.7243	289.8684	301.1991	426.2810	523.8041	549.7759	557.6525 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1156.9629	1136.3206	1039.1847	876.2455	681.1146	460.6433	304.1699	319.1526	496.6647	742.0128	965.5201	1148.1438 (97)
Space heating kWh	430.8515	333.8846	289.5405	180.5050	98.3862	0.0000	0.0000	0.0000	0.0000	162.3472	299.3358	439.3255 (98a)
Space heating requirement - total per year (kWh/year)												2234.1764
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	430.8515	333.8846	289.5405	180.5050	98.3862	0.0000	0.0000	0.0000	0.0000	162.3472	299.3358	439.3255 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2234.1764
Space heating per m2										(98c) / (4) =		29.9487 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	430.8515	333.8846	289.5405	180.5050	98.3862	0.0000	0.0000	0.0000	0.0000	162.3472	299.3358	439.3255 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	466.7947	361.7384	313.6950	195.5634	106.5940	0.0000	0.0000	0.0000	0.0000	175.8908	324.3075	475.9757 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	223.1952	197.3498	209.8152	185.1275	179.8355	162.4811	160.7939	167.0162	168.6423	187.5021	198.6562	220.8691 (64)
Efficiency of water heater (217)m	85.5090	85.2291	84.7824	84.0031	82.7664	79.8000	79.8000	79.8000	79.8000	83.7384	84.9769	79.8000 (216)
Fuel for water heating, kWh/month	261.0195	231.5522	247.4751	220.3817	217.2809	203.6104	201.4961	209.2935	211.3312	223.9142	233.7768	258.1113 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	22.4221	17.9879	16.1961	11.8659	9.1656	7.4884	8.3612	10.8682	14.1167	18.5218	20.9204	23.0453 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-34.9149	-49.2318	-70.7838	-79.6152	-85.8835	-80.1828	-79.1959	-74.7493	-66.9044	-56.3101	-38.3893	-30.1853 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-19.6997	-41.4462	-82.3846	-123.7455	-163.6291	-164.4057	-162.4666	-137.5541	-100.8182	-59.2705	-26.3022	-15.5773 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2420.5595 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												2719.2429 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												180.9595 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1843.6460 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3563.1159 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2420.5595	0.2100	508.3175 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2719.2429	0.2100	571.0410 (264)
Space and water heating			1079.3585 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	180.9595	0.1443	26.1180 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-746.3462	0.1346	-100.4418
PV Unit electricity exported	-1097.2997	0.1259	-138.1440
Total			-238.5859 (269)
Total CO2, kg/year			878.8199 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.7800 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2420.5595	1.1300	2735.2322 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2719.2429	1.1300	3072.7444 (278)
Space and water heating			5807.9767 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	180.9595	1.5338	277.5617 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-746.3462	1.4974	-1117.5619
PV Unit electricity exported	-1097.2997	0.4621	-507.0836
Total			-1624.6455 (283)
Total Primary energy kWh/year			4590.9936 (286)
Target Primary Energy Rate (TPER)			61.5400 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

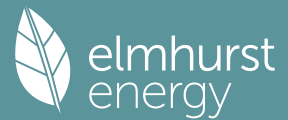
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 189.8570 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)

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Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1580 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4080	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3468 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.4422	0.4335	0.4248	0.3815	0.3728	0.3295	0.3295	0.3208	0.3468	0.3728	0.3902	0.4075	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5978	0.5940	0.5902	0.5728	0.5695	0.5543	0.5543	0.5515	0.5601	0.5695	0.5761	0.5830	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1000	0.9000	1.8900			(26a)
Windows			8.2000	1.1450	9.3893			(27)
French Doors			4.6000	1.1450	5.2672			(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000	(28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000	(29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000	(30)
Total net area of external elements Aum(A, m2)			164.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5715			(33)
Main dwelling								
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000	(32)
Internal Wall			140.0000			9.0000	1260.0000	(32c)
Internal Floor			37.3000			18.0000	671.4000	(32d)
Internal Ceiling			37.3000			9.0000	335.7000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7472.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.1729 (35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	12.9000	0.1440	1.8576	
E2 Other lintels (including other steel lintels)	9.7000	0.0480	0.4656	
E3 Sill	25.2000	0.0640	1.6128	
E4 Jamb	17.6000	0.0510	0.8976	
E5 Ground floor (normal)	17.6000	0.1300	2.2880	
E6 Intermediate floor within a dwelling	17.6000	0.0750	1.3200	
E10 Eaves (insulation at ceiling level)	0.0000	0.0620	0.0000	
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000	
E13 Gable (insulation at rafter level)	10.2000	0.0620	0.6324	
E16 Corner (normal)	0.0000	0.2400	0.0000	
R1 Head of roof window	0.0000	0.2400	0.0000	
R2 Sill of roof window	0.0000	0.2400	0.0000	
R3 Jamb of roof window	0.0000	0.2400	0.0000	
E20 Exposed floor (normal)	0.0000	0.3200	0.0000	
E18 Party wall between dwellings	10.2000	0.0440	0.4488	
P1 Party wall - Ground floor	7.2000	0.0590	0.4248	
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.7972 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =			49.3687 (37)

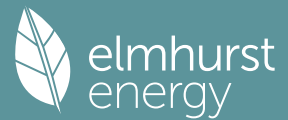
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	37.4516	37.2137	36.9806	35.8855	35.6807	34.7269	34.7269	34.5503	35.0943	35.6807	36.0951	36.5284	(38)
Average = Sum(39)m / 12 =	86.8203	86.5824	86.3493	85.2542	85.0494	84.0956	84.0956	83.9190	84.4630	85.0494	85.4638	85.8971	(39)
												85.2533	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1638	1.1606	1.1575	1.1428	1.1401	1.1273	1.1273	1.1249	1.1322	1.1401	1.1456	1.1514	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.3524 (42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071	(42b)
Hot water usage for other uses													
	38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213	(42c)
Average daily hot water use (litres/day)													60.6981 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	66.2214	64.4049	62.4218	59.9533	57.7512	55.4627	54.9871	56.9662	58.9961	61.3463	63.8366	66.1284	(44)
Energy conte	104.8785	91.7118	95.9399	82.0730	77.7442	68.1978	66.5021	70.5361	72.7481	83.2463	90.9470	103.5411	(45)
Energy content (annual)										Total = Sum(45)m =			1008.0659
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

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Total heat required for water heating calculated for each month												
	89.1467	77.9550	81.5489	69.7621	66.0826	57.9681	56.5268	59.9557	61.8359	70.7594	77.3049	88.0100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	89.1467	77.9550	81.5489	69.7621	66.0826	57.9681	56.5268	59.9557	61.8359	70.7594	77.3049	88.0100 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											856.8561 (64)
Electric shower(s)	50.9829	45.4262	49.6036	47.3362	48.2244	46.0014	47.5348	48.2244	47.3362	49.6036	48.6709	50.9829 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											579.9275 (64a)
Heat gains from water heating, kWh/month	35.0324	30.8453	32.7881	29.2746	28.5767	25.9924	26.0154	27.0450	27.2930	30.0908	31.4940	34.7482 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	107.9127	119.4748	107.9127	111.5098	107.9127	111.5098	107.9127	107.9127	111.5098	107.9127	111.5098	107.9127 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)	47.0866	45.9007	44.0701	40.6591	38.4096	36.1005	34.9669	36.3508	37.9070	40.4446	43.7416	46.7046 (72)
Total internal gains	421.0727	433.6052	414.7789	403.3978	382.9495	370.5141	356.6153	355.8431	366.4298	376.9376	398.4333	411.5226 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.1000	10.6334	0.6300	0.0000	0.7700	21.1489 (74)			
East				0.8000	19.6403	0.6300	0.0000	0.7700	7.6220 (76)			
South				3.3000	46.7521	0.6300	0.0000	0.7700	74.8421 (78)			
South				4.6000	46.7521	0.6300	0.0000	0.7700	104.3254 (78)			
Solar gains	207.9383	348.7569	467.0106	568.5761	632.7111	627.6631	605.2315	556.5637	501.5865	382.2948	247.9681	178.7159 (83)
Total gains	629.0110	782.3621	881.7895	971.9739	1015.6607	998.1773	961.8468	912.4068	868.0162	759.2324	646.4014	590.2385 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.9092	23.9749	24.0396	24.3484	24.4071	24.6839	24.6839	24.7358	24.5765	24.4071	24.2887	24.1662
alpha	2.5939	2.5983	2.6026	2.6232	2.6271	2.6456	2.6456	2.6491	2.6384	2.6271	2.6192	2.6111
util living area	0.9317	0.8882	0.8344	0.7452	0.6290	0.4850	0.3652	0.3970	0.5706	0.7771	0.8959	0.9404 (86)
MIT	18.6523	19.0980	19.5939	20.1588	20.5831	20.8511	20.9484	20.9343	20.7597	20.1929	19.3349	18.5763 (87)
Th 2	19.9491	19.9516	19.9542	19.9660	19.9682	19.9786	19.9786	19.9805	19.9746	19.9682	19.9637	19.9590 (88)
util rest of house	0.9223	0.8737	0.8133	0.7131	0.5823	0.4208	0.2870	0.3175	0.5072	0.7415	0.8799	0.9320 (89)
MIT 2	17.8332	18.2658	18.7432	19.2809	19.6618	19.8898	19.9565	19.9507	19.8210	19.3277	18.5126	17.7659 (90)
Living area fraction	18.0923	18.5291	19.0123	19.5586	19.9533	20.1939	20.2703	20.2619	20.1180	19.6014	18.7728	18.0223 (91)
MIT	18.0923	18.5291	19.0123	19.5586	19.9533	20.1939	20.2703	20.2619	20.1180	19.6014	18.7728	18.0223 (92)
Temperature adjustment	18.0923	18.5291	19.0123	19.5586	19.9533	20.1939	20.2703	20.2619	20.1180	19.6014	18.7728	18.0223 (93)

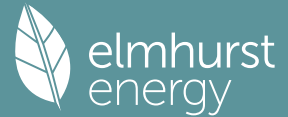
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9008	0.8500	0.7912	0.6992	0.5815	0.4349	0.3099	0.3401	0.5166	0.7273	0.8574	0.9119 (94)
Useful gains	566.6324	664.9813	697.7025	679.6166	590.6566	434.0944	298.1236	310.3045	448.4243	552.1909	554.2008	538.2119 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1197.4551	1180.0363	1080.4275	908.6917	701.9360	470.4242	308.6527	324.0867	508.2943	765.5645	997.5986	1187.2955 (97)
Space heating kWh	469.3321	346.1169	284.7474	164.9340	82.7918	0.0000	0.0000	0.0000	0.0000	158.7499	319.2464	482.9182 (98a)
Space heating requirement - total per year (kWh/year)												2308.8368
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	469.3321	346.1169	284.7474	164.9340	82.7918	0.0000	0.0000	0.0000	0.0000	158.7499	319.2464	482.9182 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2308.8368
Space heating per m2												30.9496 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	790.4987	622.3075	637.7843	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8381	0.8868	0.8699	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	662.5130	551.8495	554.8300	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1123.3878	1083.1121	1027.4525	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	331.8299	395.2594	351.6311	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	82.9575	98.8148	87.9078	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												269.6801	(107)
Energy for space heating												30.9496	(99)
Energy for space cooling												3.6150	(108)
Total												34.5646	(109)
Fabric Energy Efficiency (DFEE)												34.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 189.8570 (5)

2. Ventilation rate

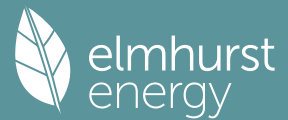
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	30.0000 / (5) = 0.1580 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4080 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3468 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1750	1.1750 (22a)
Adj infilt rate	0.4422	0.4335	0.4248	0.3815	0.3728	0.3295	0.3295	0.3208	0.3468	0.3728	0.3902	0.4075 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5978	0.5940	0.5902	0.5728	0.5695	0.5543	0.5543	0.5515	0.5601	0.5695	0.5761	0.5830 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
TER Semi-glazed door			2.1000	1.0000	2.1000		(26a)
TER Opening Type			12.8000	1.1450	14.6565		(27)
Ground Floor			37.3000	0.1300	4.8490		(28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460		(29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030		(30)
Total net area of external elements Aum(A, m ²)			164.2000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	39.1545	(33)
Main dwelling							
Party Wall			36.4000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.1729 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				12.9000	0.0500	0.6450	
E3 Sill				9.7000	0.0500	0.4850	
E4 Jamb				25.2000	0.0500	1.2600	
E5 Ground floor (normal)				17.6000	0.1600	2.8160	
E6 Intermediate floor within a dwelling				17.6000	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)				17.6000	0.0600	1.0560	
E12 Gable (insulation at ceiling level)				0.0000	0.0600	0.0000	
E13 Gable (insulation at rafter level)				0.0000	0.0800	0.0000	
E16 Corner (normal)				10.2000	0.0900	0.9180	
R1 Head of roof window				0.0000	0.0800	0.0000	
R2 Sill of roof window				0.0000	0.0600	0.0000	

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R3 Jamb of roof window	0.0000	0.0800	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0600	0.6120
P1 Party wall - Ground floor	7.2000	0.0800	0.5760
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1200	0.8640
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.2320 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	48.3865 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	37.4516	37.2137	36.9806	35.8855	35.6807	34.7269	34.7269	34.5503	35.0943	35.6807	36.0951	36.5284 (38)
Average = Sum(39)m / 12 =	85.8381	85.6002	85.3671	84.2720	84.0672	83.1134	83.1134	82.9368	83.4808	84.0672	84.4816	84.9149 (39)
												84.2711
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1506	1.1475	1.1443	1.1297	1.1269	1.1141	1.1141	1.1118	1.1190	1.1269	1.1325	1.1383 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.3524 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												27.5001 (42b)
Hot water usage for other uses												38.7213 (42c)
Average daily hot water use (litres/day)												60.6981 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	66.2214	64.4049	62.4218	59.9533	57.7512	55.4627	54.9871	56.9662	58.9961	61.3463	63.8366	66.1284 (44)
Energy content (annual)	104.8785	91.7118	95.9399	82.0730	77.7442	68.1978	66.5021	70.5361	72.7481	83.2463	90.9470	103.5411 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1008.0659
Water storage loss:												
Total storage loss												0.0000 (46)
If cylinder contains dedicated solar storage												0.0000 (56)
Primary loss												0.0000 (57)
Combi loss												0.0000 (59)
Total heat required for water heating calculated for each month												0.0000 (61)
WWHRS	89.1467	77.9550	81.5489	69.7621	66.0826	57.9681	56.5268	59.9557	61.8359	70.7594	77.3049	88.0100 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	89.1467	77.9550	81.5489	69.7621	66.0826	57.9681	56.5268	59.9557	61.8359	70.7594	77.3049	88.0100 (64)
12Total per year (kWh/year)												856.8561 (64)
Electric shower(s)												857 (64)
Heat gains from water heating, kWh/month												
	50.9829	45.4262	49.6036	47.3362	48.2244	46.0014	47.5348	48.2244	47.3362	49.6036	48.6709	50.9829 (64a)
	35.0324	30.8453	32.7881	29.2746	28.5767	25.9924	26.0154	27.0450	27.2930	30.0908	31.4940	34.7482 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	107.9127	119.4748	107.9127	111.5098	107.9127	111.5098	107.9127	107.9127	111.5098	107.9127	111.5098	107.9127 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188 (68)
Pumps, fans	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Total internal gains	47.0866	45.9007	44.0701	40.6591	38.4096	36.1005	34.9669	36.3508	37.9070	40.4446	43.7416	46.7046 (72)
	421.0727	433.6052	414.7789	403.3978	382.9495	370.5141	356.6153	355.8431	366.4298	376.9376	398.4333	411.5226 (73)

6. Solar gains												
[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.1000	10.6334	0.6300	0.7000	0.7700	13.3238 (74)			
East				0.8000	19.6403	0.6300	0.7000	0.7700	4.8019 (76)			
South				7.9000	46.7521	0.6300	0.7000	0.7700	112.8755 (78)			
Solar gains	131.0011	219.7169	294.2167	358.2030	398.6080	395.4278	381.2958	350.6351	315.9995	240.8457	156.2199	112.5910 (83)
Total gains	552.0739	653.3220	708.9956	761.6007	781.5576	765.9419	737.9111	706.4782	682.4292	617.7833	554.6532	524.1136 (84)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)

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Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.1828	24.2500	24.3162	24.6322	24.6922	24.9756	24.9756	25.0288	24.8657	24.6922	24.5711	24.4457
alpha	2.6122	2.6167	2.6211	2.6421	2.6461	2.6650	2.6650	2.6686	2.6577	2.6461	2.6381	2.6297
util living area	0.9475	0.9200	0.8856	0.8211	0.7259	0.5855	0.4539	0.4864	0.6626	0.8370	0.9220	0.9533 (86)
MIT	18.5145	18.8761	19.3313	19.9156	20.4095	20.7693	20.9150	20.8953	20.6581	20.0167	19.1787	18.4585 (87)
Th 2	19.9597	19.9623	19.9648	19.9767	19.9789	19.9893	19.9893	19.9912	19.9853	19.9789	19.9744	19.9697 (88)
util rest of house	0.9399	0.9089	0.8693	0.7945	0.6825	0.5172	0.3631	0.3962	0.5996	0.8073	0.9092	0.9466 (89)
MIT 2	17.7066	18.0614	18.5061	19.0737	19.5313	19.8462	19.9512	19.9416	19.7585	19.1814	18.3718	17.6584 (90)
Living area fraction									FLA = Living area / (4) =			0.3164 (91)
MIT	17.9622	18.3191	18.7672	19.3401	19.8091	20.1382	20.2561	20.2433	20.0431	19.4457	18.6270	17.9115 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9622	18.3191	18.7672	19.3401	19.8091	20.1382	20.2561	20.2433	20.0431	19.4457	18.6270	17.9115 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9208	0.8868	0.8464	0.7755	0.6745	0.5279	0.3881	0.4199	0.6035	0.7891	0.8881	0.9287 (94)
Useful gains	508.3732	579.3590	600.0909	590.6056	527.1568	404.3690	286.3934	296.6413	411.8205	487.5117	492.5632	486.7245 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1172.7340	1148.6793	1047.2110	879.8054	681.7106	460.3005	303.8710	318.7505	496.1355	743.6305	973.8230	1164.3146 (97)
Space heating kWh	494.2844	382.5832	332.6574	208.2238	114.9880	0.0000	0.0000	0.0000	0.0000	190.5524	346.5071	504.1270 (98a)
Space heating requirement - total per year (kWh/year)												2573.9234
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	494.2844	382.5832	332.6574	208.2238	114.9880	0.0000	0.0000	0.0000	0.0000	190.5524	346.5071	504.1270 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2573.9234
Space heating per m2										(98c) / (4) =		34.5030 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	781.2661	615.0392	630.3196	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7578	0.8222	0.8023	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	592.0684	505.7012	505.7012	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	851.9439	821.3691	786.7567	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	187.1104	234.8569	209.1053	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	46.7776	58.7142	52.2763	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												157.7681 (107)
Energy for space heating												34.5030 (99)
Energy for space cooling												2.1149 (108)
Total												36.6178 (109)
Fabric Energy Efficiency (TFEE)												36.6 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

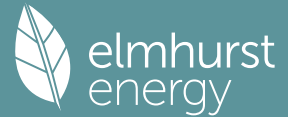
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	189.8570 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	40.0000 / (5) = 0.2107 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50 5.0000 (17)
Infiltration rate 0.4607 (18)
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3916 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4993	0.4895	0.4797	0.4307	0.4210	0.3720	0.3720	0.3622	0.3916	0.4210	0.4405	0.4601 (22b)
Effective ac	0.6246	0.6198	0.6151	0.5928	0.5886	0.5692	0.5692	0.5656	0.5767	0.5886	0.5970	0.6059 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			8.2000	1.1450	9.3893		(27)
French Doors			4.6000	1.1450	5.2672		(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000 (28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000 (29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000 (30)
Total net area of external elements Aum(A, m2)			164.2000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	38.5715	(33)
Main dwelling							
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000 (32)
Internal Wall			140.0000			9.0000	1260.0000 (32c)
Internal Floor			37.3000			18.0000	671.4000 (32d)
Internal Ceiling			37.3000			9.0000	335.7000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7472.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.1729 (35)

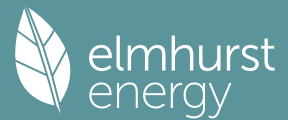
List of Thermal Bridges	Length	Psi-value	Total
K1 Element	12.9000	0.1440	1.8576
E2 Other lintels (including other steel lintels)	9.7000	0.0480	0.4656
E3 Sill	25.2000	0.0640	1.6128
E4 Jamb	17.6000	0.0510	0.8976
E5 Ground floor (normal)	17.6000	0.1300	2.2880
E6 Intermediate floor within a dwelling	17.6000	0.0750	1.3200
E10 Eaves (insulation at ceiling level)	0.0000	0.0620	0.0000
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	10.2000	0.0620	0.6324
E16 Corner (normal)	0.0000	0.2400	0.0000
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.7972 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 49.3687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.1351	38.8318	38.5346	37.1386	36.8774	35.6615	35.6615	35.4364	36.1299	36.8774	37.4058	37.9582 (38)
Average = Sum(39)m / 12 =	88.5038	88.2005	87.9033	86.5073	86.2461	85.0302	85.0302	84.8051	85.4986	86.2461	86.7745	87.3269 (39)
												86.5061
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1864	1.1823	1.1783	1.1596	1.1561	1.1398	1.1398	1.1368	1.1461	1.1561	1.1632	1.1706 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.3524 (42)
Hot water usage for mixer showers													
71.6201	70.5438	68.9754	65.9745	63.7600	61.2904	59.8866	61.4431	63.1494	65.8010	68.8663	71.3457	(42a)	
Hot water usage for baths													
27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071	(42b)	
Hot water usage for other uses													
38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213	(42c)	
Average daily hot water use (litres/day)												126.7294 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.8415	134.9487	131.3971	125.9278	121.5112	116.7530	114.8737	118.4094	122.1455	127.1473	132.7029	137.4741 (44)	
Energy content (annual)	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (45)	
Distribution loss (46)m = 0.15 x (45)m	32.7461	28.8248	30.2929	25.8583	24.5366	21.5342	20.8395	21.9923	22.5926	25.8807	28.3590	32.2877 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month													
218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (62)		
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (64)	
	Total per year (kWh/year) = Sum(64)m =											2104.9642 (64)	
Electric shower(s)													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	72.5872	63.8949	67.1492	57.3193	54.3895	47.7342	46.1941	48.7497	50.0804	57.3688	62.8623	71.5710 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.2101	23.2796	18.9322	14.3329	10.7140	9.0452	9.7737	12.7042	17.0516	21.6509	25.2698	26.9385 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	310.1297	313.3478	305.2381	287.9736	266.1801	245.6974	232.0136	228.7954	236.9051	254.1697	275.9632	296.4459 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)	97.5634	95.0817	90.2543	79.6101	73.1041	66.2975	62.0889	65.5237	69.5560	77.1086	87.3088	96.1976 (72)
Total internal gains	535.4189	533.2249	515.9405	483.4324	451.5141	419.5558	402.3920	405.5392	422.0285	454.4450	490.0575	521.0979 (73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North		4.1000	10.6334	0.6300	0.0000	0.0000	0.7700	21.1489 (74)
East		0.8000	19.6403	0.6300	0.0000	0.0000	0.7700	7.6220 (76)
South		3.3000	46.7521	0.6300	0.0000	0.0000	0.7700	74.8421 (78)
South		4.6000	46.7521	0.6300	0.0000	0.0000	0.7700	104.3254 (78)

Solar gains	207.9383	348.7569	467.0106	568.5761	632.7111	627.6631	605.2315	556.5637	501.5865	382.2948	247.9681	178.7159 (83)
Total gains	743.3572	881.9819	982.9511	1052.0085	1084.2252	1047.2190	1007.6235	962.1029	923.6150	836.7398	738.0256	699.8138 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	23.4544	23.5351	23.6146	23.9957	24.0684	24.4126	24.4126	24.4774	24.2788	24.0684	23.9218	23.7705
util living area	2.5636	2.5690	2.5743	2.5997	2.6046	2.6275	2.6275	2.6318	2.6186	2.6046	2.5948	2.5847
	0.9066	0.8636	0.8062	0.7204	0.6073	0.4704	0.3535	0.3822	0.5498	0.7472	0.8691	0.9170 (86)
MIT	19.2543	19.5475	19.9034	20.2926	20.5889	20.7774	20.8467	20.8376	20.7147	20.3271	19.7307	19.2032 (87)
Th 2	19.9309	19.9342	19.9374	19.9524	19.9553	19.9684	19.9684	19.9709	19.9634	19.9553	19.9496	19.9436 (88)
util rest of house	0.8943	0.8468	0.7828	0.6869	0.5601	0.4067	0.2767	0.3043	0.4865	0.7093	0.8501	0.9059 (89)
MIT 2	17.9128	18.2761	18.7132	19.1897	19.5298	19.7384	19.7989	19.7951	19.6766	19.2450	18.5226	17.8585 (90)
Living area fraction	18.3372	18.6783	19.0897	19.5386	19.8648	20.0671	20.1304	20.1249	20.0050	19.5873	18.9048	0.3164 (91)
MIT	18.3372	18.6783	19.0897	19.5386	19.8648	20.0671	20.1304	20.1249	20.0050	19.5873	18.9048	18.2839 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3372	18.6783	19.0897	19.5386	19.8648	20.0671	20.1304	20.1249	20.0050	19.5873	18.9048	18.2839 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8718	0.8234	0.7615	0.6724	0.5557	0.4131	0.2891	0.3164	0.4892	0.6944	0.8275	0.8843 (94)
Ext temp.	648.0426	726.1962	748.4882	707.3528	602.5208	432.5679	291.3297	304.3713	451.8389	581.0392	610.7425	618.8635 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1242.3444	1215.2563	1106.6787	920.3198	704.1851	464.8656	300.1884	315.8895	504.8716	775.1218	1024.3552	1229.9016 (97)
Space heating requirement - total per year (kWh/year)	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98a)
Solar heating kWh												2163.0879
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2163.0879
Space heating per m2										(98c) / (4) =		28.9958 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	201.6236	149.8624	121.5202	69.9207	34.4908	0.0000	0.0000	0.0000	0.0000	65.8447	135.7962	207.3016 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	114.6572	100.9271	106.0675	90.5404	85.9125	75.3999	72.9673	77.0040	79.1059	90.6185	99.2960	113.0521	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	22.9415	18.4046	16.5713	12.1408	9.3779	7.6618	8.5548	11.1199	14.4437	18.9509	21.4050	23.5792	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												986.3602	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1105.5484	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												185.1513	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2277.0600	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	986.3602	16.4900	162.6508 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1105.5484	16.4900	182.3049 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	185.1513	16.4900	30.5315 (250)
Additional standing charges			0.0000 (251)
Total energy cost			375.4872 (255)

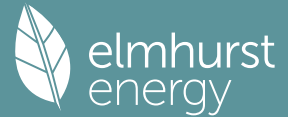
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1302 (257)
SAP value		81.6790
SAP rating (Section 12)		82 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	986.3602	0.1554	153.2369 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1105.5484	0.1416	156.5215 (264)
Space and water heating			309.7585 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	185.1513	0.1443	26.7231 (268)
Total CO2, kg/year			336.4815 (272)
CO2 emissions per m2			4.5100 (273)
EI value			96.2301
EI rating			96 (274)
EI band			A

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 189.8570 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.2107 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4607 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3916 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.4699	0.4405	0.4307	0.3818	0.3818	0.3524	0.3622	0.3426	0.3622	0.3916	0.4014	0.4307 (22b)
Effective ac	0.6104	0.5970	0.5928	0.5729	0.5729	0.5621	0.5656	0.5587	0.5656	0.5767	0.5805	0.5928 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			8.2000	1.1450	9.3893		(27)
French Doors			4.6000	1.1450	5.2672		(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000 (28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000 (29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000 (30)
Total net area of external elements Aum(A, m ²)			164.2000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5715		(33)
Main dwelling							
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000 (32)
Internal Wall			140.0000			9.0000	1260.0000 (32c)
Internal Floor			37.3000			18.0000	671.4000 (32d)
Internal Ceiling			37.3000			9.0000	335.7000 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7472.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		100.1729 (35)

List of Thermal Bridges

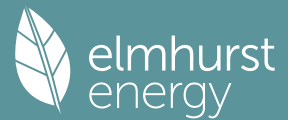
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.1440	1.8576
E3 Sill	9.7000	0.0480	0.4656
E4 Jamb	25.2000	0.0640	1.6128
E5 Ground floor (normal)	17.6000	0.0510	0.8976
E6 Intermediate floor within a dwelling	17.6000	0.1300	2.2880
E10 Eaves (insulation at ceiling level)	17.6000	0.0750	1.3200
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	0.0000	0.0620	0.0000
E16 Corner (normal)	10.2000	0.0620	0.6324
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.7972 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	49.3687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.2434	37.4058	37.1386	35.8927	35.8927	35.2172	35.4364	35.0041	35.4364	36.1299	36.3731	37.1386 (38)
Heat transfer coeff	87.6121	86.7745	86.5073	85.2614	85.2614	84.5859	84.8051	84.3728	84.8051	85.4986	85.7418	86.5073 (39)
Average = Sum(39)m / 12 =												85.6444

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1744	1.1632	1.1596	1.1429	1.1429	1.1339	1.1368	1.1310	1.1368	1.1461	1.1494	1.1596 (40)
HLP (average)												1.1480
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3524 (42)
Hot water usage for mixer showers												
71.6201	70.5438	68.9754	65.9745	63.7600	61.2904	59.8866	61.4431	63.1494	65.8010	68.8663	71.3457 (42a)	
Hot water usage for baths												
27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071 (42b)	
Hot water usage for other uses												
38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213 (42c)	
Average daily hot water use (litres/day)												126.7294 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	137.8415	134.9487	131.3971	125.9278	121.5112	116.7530	114.8737	118.4094	122.1455	127.1473	132.7029	137.4741 (44)
Energy content (annual)	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2104.9642
	32.7461	28.8248	30.2929	25.8583	24.5366	21.5342	20.8395	21.9923	22.5926	25.8807	28.3590	32.2877 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (64)
Total per year (kWh/year) = Sum(64)m = 2104.9642 (64)												
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)												
Heat gains from water heating, kWh/month												
	72.5872	63.8949	67.1492	57.3193	54.3895	47.7342	46.1941	48.7497	50.0804	57.3688	62.8623	71.5710 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.2101	23.2796	18.9322	14.3329	10.7140	9.0452	9.7737	12.7042	17.0516	21.6509	25.2698	26.9385 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	310.1297	313.3478	305.2381	287.9736	266.1801	245.6974	232.0136	228.7954	236.9051	254.1697	275.9632	296.4459 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)	97.5634	95.0817	90.2543	79.6101	73.1041	66.2975	62.0889	65.5237	69.5560	77.1086	87.3088	96.1976 (72)
Total internal gains	535.4189	533.2249	515.9405	483.4324	451.5141	419.5558	402.3920	405.5392	422.0285	454.4450	490.0575	521.0979 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				4.1000	12.7054		0.6300		0.0000		0.7700		25.2699 (74)
East				0.8000	23.7288		0.6300		0.0000		0.7700		9.2087 (76)
South				3.3000	53.5774		0.6300		0.0000		0.7700		85.7682 (78)
South				4.6000	53.5774		0.6300		0.0000		0.7700		119.5557 (78)
Solar gains	239.8025	357.4104	477.9284	617.6774	666.0748	708.8538	674.5275	622.1056	550.8340	419.1034	288.6721		199.4000 (83)
Total gains	775.2214	890.6353	993.8688	1101.1098	1117.5889	1128.4096	1076.9195	1027.6447	972.8625	873.5484	778.7296		720.4979 (84)

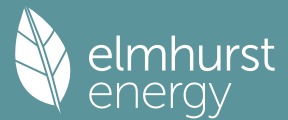
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.6931	23.9218	23.9957	24.3464	24.3464	24.5408	24.4774	24.6028	24.4774	24.2788	24.2100	23.9957
alpha	2.5795	2.5948	2.5997	2.6231	2.6231	2.6361	2.6318	2.6402	2.6318	2.6186	2.6140	2.5997
util living area	0.8898	0.8516	0.7870	0.6808	0.5514	0.3940	0.2761	0.2797	0.4730	0.6888	0.8354	0.9006 (86)
MIT	19.4354	19.6686	20.0244	20.4093	20.6780	20.8239	20.8672	20.8677	20.7835	20.4865	19.9498	19.4168 (87)
Th 2	19.9405	19.9496	19.9524	19.9659	19.9659	19.9733	19.9709	19.9756	19.9709	19.9634	19.9607	19.9524 (88)
util rest of house	0.8753	0.8333	0.7614	0.6444	0.5000	0.3291	0.2000	0.2008	0.4048	0.6433	0.8116	0.8871 (89)
MIT 2	18.1455	18.4370	18.8712	19.3345	19.6338	19.7835	19.8148	19.8202	19.7483	19.4329	18.7986	18.1327 (90)
Living area fraction												FLA = Living area / (4) = 0.3164 (91)
MIT	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8524	0.8105	0.7417	0.6333	0.4999	0.3382	0.2133	0.2147	0.4120	0.6338	0.7903	0.8648 (94)

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Useful gains	660.7601	721.8893	737.1409	697.2940	558.6775	381.6359	229.7564	220.5855	400.8529	553.6521	615.4349	623.0718	(95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Heat loss rate W	1187.4549	1165.0911	1049.8573	867.4960	627.8745	398.6194	233.0189	223.7233	430.4519	689.6491	948.5449	1153.9174	(97)
Space heating kWh	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491	(98a)
Space heating requirement - total per year (kWh/year)												1832.3516	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1832.3516	
Space heating per m2											(98c) / (4) =	24.5624	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													219.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491	(98)	
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)	
Space heating fuel (main heating system)	178.6872	135.8101	106.0926	55.8803	23.4759	0.0000	0.0000	0.0000	0.0000	46.1385	109.3658	180.0954	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513	(64)	
Efficiency of water heater													190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)	
Fuel for water heating, kWh/month	114.6572	100.9271	106.0675	90.5404	85.9125	75.3999	72.9673	77.0040	79.1059	90.6185	99.2960	113.0521	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	22.9415	18.4046	16.5713	12.1408	9.3779	7.6618	8.5548	11.1199	14.4437	18.9509	21.4050	23.5792	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													835.5456	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													190.4000	
Water heating fuel used													1105.5484	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													185.1513	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
FV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													2126.2454	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	835.5456	26.0600	217.7432	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1105.5484	26.0600	288.1059	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	185.1513	26.0600	48.2504	(250)
Additional standing charges			0.0000	(251)
Total energy cost			554.0995	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
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	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	835.5456	0.1560	130.3221 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1105.5484	0.1416	156.5215 (264)
Space and water heating			286.8436 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	185.1513	0.1443	26.7231 (268)
Total CO2, kg/year			313.5667 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	835.5456	1.5774	1318.0181 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1105.5484	1.5235	1684.3455 (278)
Space and water heating			3002.3636 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	185.1513	1.5338	283.9913 (282)
Total Primary energy kWh/year			3286.3549 (286)

SAP 10 EPC IMPROVEMENTS

DB0104

Current energy efficiency rating: B 82
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.8	-£ 72	-35 kg (11.1%)
U Solar photovoltaic panels	+ 9.0	-£ 285	-248 kg (88.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£72	0.47 kg/m²	B 84 A 97
Solar photovoltaic panels	£285	3.32 kg/m²	A 93 A 99
Total Savings	£358	3.78 kg/m²	

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£554	£482	£72
Space heating	£218	£239	-£21
Water heating	£288	£195	£93
Lighting	£48	£48	£0
Generated (PV)	-£0	-£285	£285
Total cost of fuels	£554	£197	£357
Total cost of uses	£554	£197	£357
Delivered energy	29 kWh/m²	-1 kWh/m²	30 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.0 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	0 kg/m²	4 kg/m²
Primary energy	44 kWh/m²	15 kWh/m²	29 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

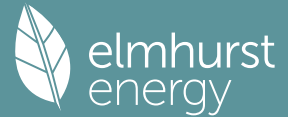
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Main dwelling			
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200 (1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 189.8570 (5)

2. Ventilation rate

	m³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)

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Number of flues attached to solid fuel boiler
Number of flues attached to other heater
Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
4 * 10 = 40.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.2107 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.4607 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3916 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Adj infilt rate												
	0.4993	0.4895	0.4797	0.4307	0.4210	0.3720	0.3720	0.3622	0.3916	0.4210	0.4405	0.4601
Effective ac	0.6246	0.6198	0.6151	0.5928	0.5886	0.5692	0.5692	0.5656	0.5767	0.5886	0.5970	0.6059

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			8.2000	1.1450	9.3893		(27)
French Doors			4.6000	1.1450	5.2672		(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000 (28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000 (29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000 (30)
Total net area of external elements Aum(A, m2)			164.2000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5715		(33)
Main dwelling							
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000 (32)
Internal Wall			140.0000			9.0000	1260.0000 (32c)
Internal Floor			37.3000			18.0000	671.4000 (32d)
Internal Ceiling			37.3000			9.0000	335.7000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 7472.9000 (34)
100.1729 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	12.9000	0.1440	1.8576
E2 Other lintels (including other steel lintels)	9.7000	0.0480	0.4656
E3 Sill	25.2000	0.0640	1.6128
E4 Jamb	17.6000	0.0510	0.8976
E5 Ground floor (normal)	17.6000	0.1300	2.2880
E6 Intermediate floor within a dwelling	17.6000	0.0750	1.3200
E10 Eaves (insulation at ceiling level)	0.0000	0.0620	0.0000
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	10.2000	0.0620	0.6324
E16 Corner (normal)	0.0000	0.2400	0.0000
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.3687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

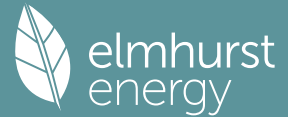
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	39.1351	38.8318	38.5346	37.1386	36.8774	35.6615	35.6615	35.4364	36.1299	36.8774	37.4058	37.9582
Heat transfer coeff	88.5038	88.2005	87.9033	86.5073	86.2461	85.0302	85.0302	84.8051	85.4986	86.2461	86.7745	87.3269
Average = Sum(39)m / 12 =												86.5061

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1864	1.1823	1.1783	1.1596	1.1561	1.1398	1.1398	1.1368	1.1461	1.1561	1.1632	1.1706
HLP (average)												1.1596
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3524 (42)
Hot water usage for mixer showers 71.6201 70.5438 68.9754 65.9745 63.7600 61.2904 59.8866 61.4431 63.1494 65.8010 68.8663 71.3457 (42a)
Hot water usage for baths 27.5001 27.0917 26.5166 25.4561 24.6621 23.7816 23.3060 23.8771 24.4989 25.4411 26.5234 27.4071 (42b)
Hot water usage for other uses 38.7213 37.3133 35.9052 34.4972 33.0891 31.6811 31.6811 33.0891 34.4972 35.9052 37.3133 38.7213 (42c)
Average daily hot water use (litres/day) 126.7294 (43)
Daily hot water use
Energy conte 137.8415 134.9487 131.3971 125.9278 121.5112 116.7530 114.8737 118.4094 122.1455 127.1473 132.7029 137.4741 (44)
Energy content (annual) 218.3072 192.1652 201.9525 172.3889 163.5774 143.5614 138.9298 146.6155 150.6176 172.5377 189.0597 215.2513 (45)
Distribution loss (46)m = 0.15 x (45)m
32.7461 28.8248 30.2929 25.8583 24.5366 21.5342 20.8395 21.9923 22.5926 25.8807 28.3590 32.2877 (46)
Water storage loss:
Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												
Zero-loss collector efficiency												3.0000 (H1)
Collector linear heat loss coefficient												0.8000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector loop efficiency												0.0000 (H4)
Incidence angle modifier												0.9000 (H5)
Overshading factor												1.0000 (H6)
Overall heat loss coefficient of system												0.8000 (H8)
Heat loss coefficient of collector loop												6.5000 (H10)
Dedicated solar storage volume												3.9667 (H11)
Effective solar volume												75.0000 (H12)
Reference volume												75.0000 (H14)
Storage tank correction coefficient												225.0000 (H15)
Heat delivered to hot water												1.3161 (H16)
Heat delivered to space heating												585.1787 (H24)
Solar input												0.0000 (H29)
Solar input	-0.0000	-16.2693	-56.5667	-76.2103	-97.7898	-89.1038	-87.6955	-78.1221	-55.0327	-28.3885	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	218.3072	175.8959	145.3858	96.1785	65.7876	54.4577	51.2343	68.4935	95.5849	144.1492	189.0597	215.2513 (64)
Total per year (kWh/year) = Sum(64)m =												1519.7855 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	72.5872	63.8949	67.1492	57.3193	54.3895	47.7342	46.1941	48.7497	50.0804	57.3688	62.8623	71.5710 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462	141.1462 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	26.2101	23.2796	18.9322	14.3329	10.7140	9.0452	9.7737	12.7042	17.0516	21.6509	25.2698	26.9385 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	310.1297	313.3478	305.2381	287.9736	266.1801	245.6974	232.0136	228.7954	236.9051	254.1697	275.9632	296.4459 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671	51.4671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)												
	97.5634	95.0817	90.2543	79.6101	73.1041	66.2975	62.0889	65.5237	69.5560	77.1086	87.3088	96.1976 (72)
Total internal gains	535.4189	533.2249	515.9405	483.4324	451.5141	419.5558	402.3920	405.5392	422.0285	454.4450	490.0575	521.0979 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.1000	10.6334	0.6300	0.0000	0.7700	21.1489 (74)			
East				0.8000	19.6403	0.6300	0.0000	0.7700	7.6220 (76)			
South				3.3000	46.7521	0.6300	0.0000	0.7700	74.8421 (78)			
South				4.6000	46.7521	0.6300	0.0000	0.7700	104.3254 (78)			
Solar gains	207.9383	348.7569	467.0106	568.5761	632.7111	627.6631	605.2315	556.5637	501.5865	382.2948	247.9681	178.7159 (83)
Total gains	743.3572	881.9819	982.9511	1052.0085	1084.2252	1047.2190	1007.6235	962.1029	923.6150	836.7398	738.0256	699.8138 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.4544	23.5351	23.6146	23.9957	24.0684	24.4126	24.4126	24.4774	24.2788	24.0684	23.9218	23.7705
alpha	2.5636	2.5690	2.5743	2.5997	2.6046	2.6275	2.6275	2.6318	2.6186	2.6046	2.5948	2.5847
util living area	0.9066	0.8636	0.8062	0.7204	0.6073	0.4704	0.3535	0.3822	0.5498	0.7472	0.8691	0.9170 (86)
MIT	19.2543	19.5475	19.9034	20.2926	20.5889	20.7774	20.8467	20.8376	20.7147	20.3271	19.7307	19.2032 (87)
Th 2	19.9309	19.9342	19.9374	19.9524	19.9553	19.9684	19.9684	19.9709	19.9634	19.9553	19.9496	19.9436 (88)
util rest of house												
	0.8943	0.8468	0.7828	0.6869	0.5601	0.4067	0.2767	0.3043	0.4865	0.7093	0.8501	0.9059 (89)
MIT 2	17.9128	18.2761	18.7132	19.1897	19.5298	19.7384	19.7989	19.7951	19.6766	19.2450	18.5226	17.8585 (90)
Living area fraction												
												FLA = Living area / (4) =
MIT	18.3372	18.6783	19.0897	19.5386	19.8648	20.0671	20.1304	20.1249	20.0050	19.5873	18.9048	0.3164 (91)
Temperature adjustment												18.2839 (92)
adjusted MIT	18.3372	18.6783	19.0897	19.5386	19.8648	20.0671	20.1304	20.1249	20.0050	19.5873	18.9048	0.0000 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8718	0.8234	0.7615	0.6724	0.5557	0.4131	0.2891	0.3164	0.4892	0.6944	0.8275	0.8843 (94)
Useful gains	648.0426	726.1962	748.4882	707.3528	602.5208	432.5679	291.3297	304.3713	451.8389	581.0392	610.7425	618.8635 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1242.3444	1215.2563	1106.6787	920.3198	704.1851	464.8656	300.1884	315.8895	504.8716	775.1218	1024.3552	1229.9016 (97)
Space heating kWh	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98a)
Space heating requirement - total per year (kWh/year)												2163.0879
Solar heating kWh												

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Solar heating contribution - total per year (kWh/year)	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Space heating kWh	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2163.0879
Space heating per m2										(98c) / (4) =		28.9958 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	442.1605	328.6484	266.4938	153.3362	75.6382	0.0000	0.0000	0.0000	0.0000	144.3974	297.8011	454.6124 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	201.6236	149.8624	121.5202	69.9207	34.4908	0.0000	0.0000	0.0000	0.0000	65.8447	135.7962	207.3016 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	218.3072	175.8959	145.3858	96.1785	65.7876	54.4577	51.2343	68.4935	95.5849	144.1492	189.0597	215.2513 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	114.6572	92.3823	76.3581	50.5139	34.5523	28.6017	26.9088	35.9735	50.2021	75.7086	99.2960	113.0521 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	22.9415	18.4046	16.5713	12.1408	9.3779	7.6618	8.5548	11.1199	14.4437	18.9509	21.4050	23.5792 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-37.4685	-55.2043	-81.2634	-91.0982	-95.1388	-83.8465	-82.5205	-78.6295	-70.6796	-62.1572	-41.7099	-32.1163 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-12.6180	-28.3757	-61.0828	-99.6739	-140.5440	-147.8672	-146.1311	-121.1445	-85.7835	-44.6886	-17.6999	-9.7976 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												986.3602 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												798.2067 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												185.1513 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1727.2394 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												322.4788 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	986.3602	16.4900	162.6508 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	798.2067	16.4900	131.6243 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	185.1513	16.4900	30.5315 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-811.8326	16.4900	-133.8712
PV Unit electricity exported	-915.4068	5.5900	-51.1712
Total			-185.0424 (252)
Total energy cost			152.9561 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4604 (257)

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SAP value
SAP rating (Section 12)
SAP band

92.5369
93 (258)
A

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	986.3602	0.1554	153.2369	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	798.2067	0.1469	117.2278	(264)
Space and water heating			270.4647	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	185.1513	0.1443	26.7231	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-811.8326	0.1350	-109.5960	
PV Unit electricity exported	-915.4068	0.1233	-112.8433	
Total			-222.4393	(269)
Total CO2, kg/year			85.8455	(272)
CO2 emissions per m2			1.1500	(273)
EI value			99.0382	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	37.3000 (1b)	x 2.4000 (2b)	= 89.5200	(1b) - (3b)
First floor	37.3000 (1c)	x 2.6900 (2c)	= 100.3370	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 189.8570	(5)

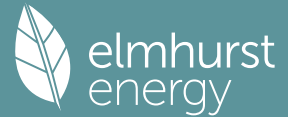
2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2107 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4607	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3916	(21)
Wind speed	Jan 4.8000 Feb 4.5000 Mar 4.4000 Apr 3.9000 May 3.9000 Jun 3.6000 Jul 3.7000 Aug 3.5000 Sep 3.7000 Oct 4.0000 Nov 4.1000 Dec 4.4000		(22)
Wind factor	1.2000 1.1250 1.1000 0.9750 0.9750 0.9000 0.9250 0.8750 0.9250 1.0000 1.0250 1.1000		(22a)
Adj infilt rate	0.4699 0.4405 0.4307 0.3818 0.3818 0.3524 0.3622 0.3426 0.3622 0.3916 0.4014 0.4307		(22b)
Effective ac	0.6104 0.5970 0.5928 0.5729 0.5729 0.5621 0.5656 0.5587 0.5656 0.5767 0.5805 0.5928		(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1000	0.9000	1.8900			(26a)
Windows			8.2000	1.1450	9.3893			(27)
French Doors			4.6000	1.1450	5.2672			(27)
Ground Floor			37.3000	0.1200	4.4760	75.0000	2797.5000	(28a)
Wall (cavity)	89.6000	14.9000	74.7000	0.1800	13.4460	18.0000	1344.6000	(29a)
Roof (loft)	37.3000		37.3000	0.1100	4.1030	9.0000	335.7000	(30)
Total net area of external elements Aum (A, m2)			164.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5715			(33)
Main dwelling								
Party Wall			36.4000	0.0000	0.0000	20.0000	728.0000	(32)
Internal Wall			140.0000			9.0000	1260.0000	(32c)
Internal Floor			37.3000			18.0000	671.4000	(32d)
Internal Ceiling			37.3000			9.0000	335.7000	(32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7472.9000	(34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

100.1729 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	12.9000	0.1440	1.8576
E2 Other lintels (including other steel lintels)	9.7000	0.0480	0.4656
E3 Sill	25.2000	0.0640	1.6128
E4 Jamb	17.6000	0.0510	0.8976
E5 Ground floor (normal)	17.6000	0.1300	2.2880
E6 Intermediate floor within a dwelling	17.6000	0.0750	1.3200
E10 Eaves (insulation at ceiling level)	0.0000	0.0620	0.0000
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000
E13 Gable (insulation at rafter level)	10.2000	0.0620	0.6324
E16 Corner (normal)	0.0000	0.2400	0.0000
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E18 Party wall between dwellings	10.2000	0.0440	0.4488
P1 Party wall - Ground floor	7.2000	0.0590	0.4248
P4 Party wall - Roof (insulation at ceiling level)	7.2000	0.1180	0.8496

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 49.3687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.2434	37.4058	37.1386	35.8927	35.8927	35.2172	35.4364	35.0041	35.4364	36.1299	36.3731	37.1386	(38)
Heat transfer coeff	87.6121	86.7745	86.5073	85.2614	85.2614	84.5859	84.8051	84.3728	84.8051	85.4986	85.7418	86.5073	(39)
Average = Sum(39)m / 12 =												85.6444	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1744	1.1632	1.1596	1.1429	1.1429	1.1339	1.1368	1.1310	1.1368	1.1461	1.1494	1.1596	(40)
HLP (average)												1.1480	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.3524 (42)

Hot water usage for mixer showers

71.6201 70.5438 68.9754 65.9745 63.7600 61.2904 59.8866 61.4431 63.1494 65.8010 68.8663 71.3457 (42a)

Hot water usage for baths

27.5001 27.0917 26.5166 25.4561 24.6621 23.7816 23.3060 23.8771 24.4989 25.4411 26.5234 27.4071 (42b)

Hot water usage for other uses

38.7213 37.3133 35.9052 34.4972 33.0891 31.6811 31.6811 33.0891 34.4972 35.9052 37.3133 38.7213 (42c)

Average daily hot water use (litres/day)

126.7294 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.8415	134.9487	131.3971	125.9278	121.5112	116.7530	114.8737	118.4094	122.1455	127.1473	132.7029	137.4741	(44)
Energy conte	218.3072	192.1652	201.9525	172.3889	163.5774	143.5614	138.9298	146.6155	150.6176	172.5377	189.0597	215.2513	(45)
Energy content (annual)										Total = Sum(45)m =		2104.9642	

Distribution loss (46)m = 0.15 x (45)m

32.7461 28.8248 30.2929 25.8583 24.5366 21.5342 20.8395 21.9923 22.5926 25.8807 28.3590 32.2877 (46)

Water storage loss:

Total storage loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)

If cylinder contains dedicated solar storage

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)

Primary loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Combi loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month

218.3072 192.1652 201.9525 172.3889 163.5774 143.5614 138.9298 146.6155 150.6176 172.5377 189.0597 215.2513 (62)

WWHRS

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

PV diverter

-0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Aperture area of solar collector

3.0000 (H1)

Zero-loss collector efficiency

0.8000 (H2)

Collector linear heat loss coefficient

1.8000 (H3)

Collector 2nd order heat loss coefficient

0.0000 (H4)

Collector loop efficiency

0.9000 (H5)

Incidence angle modifier

1.0000 (H6)

Overshading factor

0.8000 (H8)

Overall heat loss coefficient of system

6.5000 (H10)

Heat loss coefficient of collector loop

3.9667 (H11)

Dedicated solar storage volume

75.0000 (H12)

Effective solar volume

75.0000 (H14)

Reference volume

225.0000 (H15)

Storage tank correction coefficient

1.3161 (H16)

Heat delivered to hot water

680.7527 (H24)

Heat delivered to space heating

0.0000 (H29)

Solar input

680.7527

Solar input

-1.0063 -19.8383 -61.9997 -87.3255 -105.6509 -102.3216 -99.4941 -91.4019 -66.1835 -38.4367 -7.0941 -0.0000 (63c)

FGHRS

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h

217.3009 172.3269 139.9528 85.0634 57.9265 41.2398 39.4356 55.2136 84.4341 134.1010 181.9656 215.2513 (64)

Electric shower(s)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Heat gains from water heating, kWh/month

72.5872 63.8949 67.1492 57.3193 54.3895 47.7342 46.1941 48.7497 50.0804 57.3688 62.8623 71.5710 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 141.1462 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

26.2101 23.2796 18.9322 14.3329 10.7140 9.0452 9.7737 12.7042 17.0516 21.6509 25.2698 26.9385 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

310.1297 313.3478 305.2381 287.9736 266.1801 245.6974 232.0136 228.7954 236.9051 254.1697 275.9632 296.4459 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 51.4671 (69)

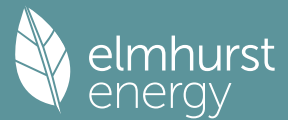
Pumps, fans

3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

-94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 -94.0975 (71)

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Water heating gains (Table 5)	97.5634	95.0817	90.2543	79.6101	73.1041	66.2975	62.0889	65.5237	69.5560	77.1086	87.3088	96.1976 (72)
Total internal gains	535.4189	533.2249	515.9405	483.4324	451.5141	419.5558	402.3920	405.5392	422.0285	454.4450	490.0575	521.0979 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					4.1000	12.7054	0.6300		0.0000		0.7700		25.2699 (74)	
East					0.8000	23.7288	0.6300		0.0000		0.7700		9.2087 (76)	
South					3.3000	53.5774	0.6300		0.0000		0.7700		85.7682 (78)	
South					4.6000	53.5774	0.6300		0.0000		0.7700		119.5557 (78)	
Solar gains	239.8025	357.4104	477.9284	617.6774	666.0748	708.8538	674.5275	622.1056	550.8340	419.1034	288.6721	199.4000 (83)		
Total gains	775.2214	890.6353	993.8688	1101.1098	1117.5889	1128.4096	1076.9195	1027.6447	972.8625	873.5484	778.7296	720.4979 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	23.6931	23.9218	23.9957	24.3464	24.3464	24.5408	24.4774	24.6028	24.4774	24.2788	24.2100	23.9957
alpha	2.5795	2.5948	2.5997	2.6231	2.6231	2.6318	2.6318	2.6402	2.6318	2.6186	2.6140	2.5997
util living area	0.8898	0.8516	0.7870	0.6808	0.5514	0.3940	0.2761	0.2797	0.4730	0.6888	0.8354	0.9006 (86)
MIT	19.4354	19.6686	20.0244	20.4093	20.6780	20.8239	20.8672	20.8677	20.7835	20.4865	19.9498	19.4168 (87)
Th 2	19.9405	19.9496	19.9524	19.9659	19.9659	19.9733	19.9709	19.9756	19.9709	19.9634	19.9607	19.9524 (88)
util rest of house	0.8753	0.8333	0.7614	0.6444	0.5000	0.3291	0.2000	0.2008	0.4048	0.6433	0.8116	0.8871 (89)
MIT 2	18.1455	18.4370	18.8712	19.3345	19.6338	19.7835	19.8148	19.8202	19.7483	19.4329	18.7986	18.1327 (90)
Living area fraction	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (92)
MIT	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (92)
Temperature adjustment	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (93)
adjusted MIT	18.5535	18.8267	19.2361	19.6745	19.9641	20.1126	20.1477	20.1516	20.0758	19.7662	19.1628	18.5390 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8524	0.8105	0.7417	0.6333	0.4999	0.3382	0.2133	0.2147	0.4120	0.6338	0.7903	0.8648 (94)
Useful gains	660.7601	721.8893	737.1409	697.2940	558.6775	381.6359	229.7564	220.5855	400.8529	553.6521	615.4349	623.0718 (95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Heat loss rate W	1187.4549	1165.0911	1049.8573	867.4960	627.8745	398.6194	233.0189	223.7233	430.4519	689.6491	948.5449	1153.9174 (97)
Space heating kWh	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491 (98a)
Space heating requirement - total per year (kWh/year)												1832.3516
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1832.3516
Space heating per m ²										(98c) / (4) =		24.5624 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	391.8609	297.8316	232.6610	122.5454	51.4826	0.0000	0.0000	0.0000	0.0000	101.1817	239.8392	394.9491 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	178.6872	135.8101	106.0926	55.8803	23.4759	0.0000	0.0000	0.0000	0.0000	46.1385	109.3658	180.0954 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	217.3009	172.3269	139.9528	85.0634	57.9265	41.2398	39.4356	55.2136	84.4341	134.1010	181.9656	215.2513 (64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	114.1286	90.5078	73.5046	44.6761	30.4236	21.6596	20.7120	28.9987	44.3456	70.4312	95.5702	113.0521 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	22.9415	18.4046	16.5713	12.1408	9.3779	7.6618	8.5548	11.1199	14.4437	18.9509	21.4050	23.5792 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-43.0168	-57.2203	-83.3294	-94.9471	-96.0484	-87.6566	-85.9451	-82.7354	-75.0550	-66.4432	-47.6836	-35.8876 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-16.4236	-31.0750	-66.6367	-116.9013	-155.5893	-176.7857	-171.9735	-144.7662	-101.4410	-54.3145	-23.5362	-12.1989	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													835.5456	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													190.4000	
Water heating fuel used													748.0102	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													80.0000	(231)
Electricity for lighting (calculated in Appendix L)													185.1513	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1927.6103	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													-78.9031	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	835.5456	26.0600	217.7432	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	748.0102	26.0600	194.9315	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	185.1513	26.0600	48.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.9683	26.0600	-223.0653	
PV Unit electricity exported	-1071.6419	5.8100	-62.2624	
Total			-285.3277	(252)
Total energy cost			196.4454	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	835.5456	0.1560	130.3221	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	748.0102	0.1480	110.7285	(264)
Space and water heating			241.0506	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	185.1513	0.1443	26.7231	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.9683	0.1352	-115.7401	
PV Unit electricity exported	-1071.6419	0.1230	-131.8004	
Total			-247.5406	(269)
Total CO2, kg/year			31.3300	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	835.5456	1.5774	1318.0181	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	748.0102	1.5477	1157.6725	(278)
Space and water heating			2475.6906	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	185.1513	1.5338	283.9913	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-855.9683	1.4998	-1283.7590	
PV Unit electricity exported	-1071.6419	0.4512	-483.5687	
Total			-1767.3277	(283)
Total Primary energy kWh/year			1113.3781	(286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 07 Apr 2025 15:05:29

Project Information			
Assessed By	Joe Solti	Building Type	House, Detached
OCDEA Registration	EES/003578	Assessment Date	2025-04-07

Dwelling Details			
Assessment Type	As designed	Total Floor Area	132 m ²
Site Reference	DB0105	Plot Reference	DB0105
Address	R/O Karenza Plot 5 Hook Lane, Aldingbourne		

Client Details	
Name	.
Company	.
Address	., ., .

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	9.81 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	3.96 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	51.22 kWh _{PE} /m ²		
Dwelling primary energy	41.1 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	41.3 kWh/m ²		
Dwelling fabric energy efficiency	39.0 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.12	Exposed Floor (0.2)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.18	Windows (N) (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	150.5	0.18	
Ground floor: Ground Floor, Ground Floor	65.5	0.12	
Upper floor: Exposed Floor, Exposed Floor	3.1	0.2	
Exposed roof: Roof (1)	66.9	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front Door, Front Door	2.1	North	N/A	0.9 (!)
Windows (N), Windows	8.4	North	1.0	1.2
Windows (S), Windows	6.6	South	1.0	1.2
Windows (E), Windows	3.9	East	1.0	1.2
Windows (W), Windows	0.7	West	1.0	1.2
French Doors, French Doors	15.1	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.144	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.048	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.064	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.051	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.13	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.075	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.062	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.062	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.062	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
External wall	E20: Exposed floor (normal)	SAP table default	0.32	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	219.3%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

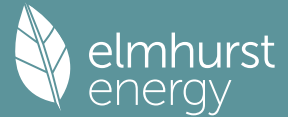
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

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Property Reference	DB0105			Issued on Date	07/04/2025
Assessment Reference	DB0105	Prop Type Ref	New Dwelling		
Property	Plot 5, R/O Karenza, Hook Lane, Aldingbourne, West Sussex				
SAP Rating	81 B	DER	3.96	TER	9.81
Environmental	96 A	% DER < TER			59.63
CO ₂ Emissions (t/year)	0.47	DFEE	39.05	TFEE	41.31
Compliance Check	See BREL	% DFEE < TFEE			5.49
% DPER < TPER	19.76	DPER	41.10	TPER	51.22
Assessor Details	Mr. Joe Solti			Assessor ID	5122-0001
Client	SBC Limited, .				

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	65.5000 (1b)	x 2.4000 (2b)	= 157.2000 (1b) - (3b)
First floor	66.9000 (1c)	x 2.6900 (2c)	= 179.9610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 337.1610 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1186 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3686 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3410 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4348	0.4262	0.4177	0.3751	0.3666	0.3239	0.3239	0.3154	0.3410	0.3666	0.3836	0.4007 (22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5803 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			19.6000	1.1450	22.4427		(27)
French Doors			15.1000	1.1450	17.2901		(27)
Ground Floor			65.5000	0.1200	7.8600	75.0000	4912.5000 (28a)
Exposed Floor			3.1000	0.2000	0.6200	20.0000	62.0000 (28b)
Wall (cavity)	187.3000	36.8000	150.5000	0.1800	27.0900	18.0000	2709.0000 (29a)
Roof (loft)	66.9000		66.9000	0.1100	7.3590	9.0000	602.1000 (30)
Total net area of external elements Aum(A, m ²)			322.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.5518		(33)
Main dwelling							
Internal Wall			210.0000			9.0000	1890.0000 (32c)
Internal Floor			65.5000			18.0000	1179.0000 (32d)
Internal Ceiling			65.5000			9.0000	589.5000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11944.1000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							90.2122 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				29.0000	0.1440	4.1760	

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E3 Sill									20.8000	0.0480	0.9984	
E4 Jamb									45.2000	0.0640	2.8928	
E5 Ground floor (normal)									36.8000	0.0510	1.8768	
E6 Intermediate floor within a dwelling									31.8000	0.1300	4.1340	
E10 Eaves (insulation at ceiling level)									21.9000	0.0750	1.6425	
E12 Gable (insulation at ceiling level)									18.8000	0.0620	1.1656	
E13 Gable (insulation at rafter level)									0.0000	0.0620	0.0000	
E16 Corner (normal)									40.7000	0.0620	2.5234	
R1 Head of roof window									0.0000	0.2400	0.0000	
R2 Sill of roof window									0.0000	0.2400	0.0000	
R3 Jamb of roof window									0.0000	0.2400	0.0000	
E20 Exposed floor (normal)									5.2000	0.3200	1.6640	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												21.0735 (36)
Point Thermal bridges												(36a) = 0.0000
Total fabric heat loss												(33) + (36) + (36a) = 105.6253 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	66.1469	65.7386	65.3384	63.4585	63.1067	61.4694	61.4694	61.1662	62.1001	63.1067	63.8183	64.5622 (38)
Average = Sum(39)m / 12 =	171.7723	171.3639	170.9637	169.0838	168.7321	167.0947	167.0947	166.7915	167.7254	168.7321	169.4436	170.1875 (39)
												169.0821
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2974	1.2943	1.2913	1.2771	1.2744	1.2620	1.2620	1.2598	1.2668	1.2744	1.2798	1.2854 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.9010 (42)
Hot water usage for mixer showers												
	81.9667	80.7349	78.9399	75.5056	72.9711	70.1447	68.5381	70.3195	72.2723	75.3070	78.8151	81.6527 (42a)
Hot water usage for baths												
	31.4551	30.9879	30.3301	29.1171	28.2089	27.2018	26.6578	27.3111	28.0223	29.1000	30.3379	31.3488 (42b)
Hot water usage for other uses												
	44.3387	42.7264	41.1140	39.5017	37.8894	36.2771	36.2771	37.8894	39.5017	41.1140	42.7264	44.3387 (42c)
Average daily hot water use (litres/day)												145.0423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	157.7605	154.4492	150.3841	144.1244	139.0694	133.6236	131.4730	135.5200	139.7963	145.5210	151.8794	157.3401 (44)
Energy content (annual)	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2409.1387
	37.4781	32.9900	34.6702	29.5949	28.0821	24.6459	23.8508	25.1703	25.8574	29.6206	32.4570	36.9535 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2409.1387 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	83.0765	73.1279	76.8523	65.6020	62.2487	54.6317	52.8692	55.7942	57.3173	65.6590	71.9463	81.9136 (65)

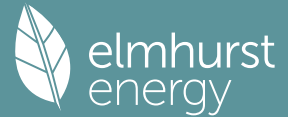
5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	151.6134	167.8577	151.6134	156.6672	151.6134	156.6672	151.6134	151.6134	156.6672	151.6134	156.6672	151.6134 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.5905	303.7097	295.8494	279.1159	257.9927	238.1400	224.8772	221.7580	229.6182	246.3518	267.4749	287.3276 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382 (71)
Water heating gains (Table 5)	111.6619	108.8213	103.2961	91.1138	83.6676	75.8773	71.0608	74.9922	79.6074	88.2513	99.9255	110.0989 (72)
Total internal gains	633.3801	649.9029	620.2732	596.4112	562.7880	537.1988	514.0657	514.8778	532.4070	555.7308	593.5818	618.5542 (73)

6. Solar gains												

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	W/m2	or Table 6b	Factor	W						
North	8.4000	10.6334	0.6300	0.0000	0.7700	43.3294 (74)						
East	3.9000	19.6403	0.6300	0.0000	0.7700	37.1572 (76)						
South	6.6000	46.7521	0.6300	0.0000	0.7700	149.6842 (78)						
West	0.7000	19.6403	0.6300	0.0000	0.7700	6.6692 (80)						
South	15.1000	46.7521	0.6300	0.0000	0.7700	342.4593 (78)						

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Solar gains	579.2994	974.5428	1308.6033	1592.3294	1766.0264	1747.9650	1687.2485	1556.8748	1405.9011	1069.6499	691.4568	497.4196 (83)
Total gains	1212.6795	1624.4458	1928.8765	2188.7406	2328.8144	2285.1638	2201.3142	2071.7527	1938.3082	1625.3806	1285.0386	1115.9737 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.3151	19.3612	19.4065	19.6223	19.6632	19.8558	19.8558	19.8919	19.7812	19.6632	19.5806	19.4950	
alpha	2.2877	2.2907	2.2938	2.3082	2.3109	2.3237	2.3237	2.3261	2.3187	2.3109	2.3054	2.2997	
util living area	0.9144	0.8519	0.7781	0.6738	0.5528	0.4216	0.3161	0.3463	0.5083	0.7242	0.8700	0.9266 (86)	
MIT	18.8180	19.2641	19.7258	20.1983	20.5372	20.7438	20.8223	20.8101	20.6659	20.1900	19.4183	18.7336 (87)	
Th 2	19.8429	19.8453	19.8477	19.8588	19.8609	19.8707	19.8707	19.8725	19.8669	19.8609	19.8567	19.8523 (88)	
util rest of house	0.9030	0.8340	0.7525	0.6378	0.5043	0.3584	0.2409	0.2690	0.4436	0.6841	0.8510	0.9167 (89)	
MIT 2	17.3197	17.8707	18.4339	19.0018	19.3863	19.6090	19.6775	19.6711	19.5359	19.0128	18.0817	17.2208 (90)	
Living area fraction									FLA = Living area / (4) =				0.1790 (91)
MIT	17.5879	18.1201	18.6652	19.2160	19.5923	19.8121	19.8825	19.8750	19.7382	19.2235	18.3210	17.4916 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.5879	18.1201	18.6652	19.2160	19.5923	19.8121	19.8825	19.8750	19.7382	19.2235	18.3210	17.4916 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8739	0.8015	0.7222	0.6154	0.4920	0.3550	0.2417	0.2692	0.4358	0.6585	0.8191	0.8895 (94)
Useful gains	1059.8148	1301.9711	1392.9849	1347.0443	1145.7555	811.2051	532.0166	557.7180	844.6286	1070.3081	1052.5392	992.6341 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2282.4953	2265.4554	2079.8042	1744.2651	1331.6831	870.9138	548.4832	579.6002	945.6677	1455.0689	1901.3233	2262.0651 (97)
Space heating kWh	909.6743	647.4615	510.9936	285.9990	138.3301	0.0000	0.0000	0.0000	0.0000	286.2620	611.1245	944.4566 (98a)
Space heating requirement - total per year (kWh/year)												4334.3016
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	909.6743	647.4615	510.9936	285.9990	138.3301	0.0000	0.0000	0.0000	0.0000	286.2620	611.1245	944.4566 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4334.3016
Space heating per m2											(98c) / (4) =	32.7364 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	909.6743	647.4615	510.9936	285.9990	138.3301	0.0000	0.0000	0.0000	0.0000	286.2620	611.1245	944.4566 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	414.8082	295.2401	233.0112	130.4145	63.0780	0.0000	0.0000	0.0000	0.0000	130.5344	278.6705	430.6688 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	131.2259	115.5113	121.3943	103.6235	98.3268	86.2950	83.5112	88.1313	90.5372	103.7135	113.6449	129.3889 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	32.2320	25.8577	23.2820	17.0574	13.1756	10.7646	12.0192	15.6231	20.2928	26.6253	30.0732	33.1278 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1976.4257 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1265.3039 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												260.1308 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3501.8604 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1976.4257	0.1556	307.5094 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1265.3039	0.1416	179.1395 (264)
Space and water heating			486.6488 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	260.1308	0.1443	37.5449 (268)
Total CO2, kg/year			524.1938 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9600 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1976.4257	1.5760	3114.8181 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1265.3039	1.5235	1927.7392 (278)
Space and water heating			5042.5574 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	260.1308	1.5338	398.9972 (282)
Total Primary energy kWh/year			5441.5546 (286)
Dwelling Primary energy Rate (DPER)			41.1000 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	65.5000 (1b)	x 2.4000 (2b)	= 157.2000 (1b) - (3b)
First floor	66.9000 (1c)	x 2.6900 (2c)	= 179.9610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	337.1610 (5)

2. Ventilation rate

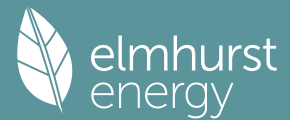
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1186 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3686 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3410 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4348	0.4262	0.4177	0.3751	0.3666	0.3239	0.3239	0.3154	0.3410	0.3666	0.3836	0.4007 (22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5803 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							

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TER Semi-glazed door			2.1000	1.0000	2.1000	(26a)
TER Opening Type			31.0000	1.1450	35.4962	(27)
Ground Floor			65.5000	0.1300	8.5150	(28a)
Exposed Floor			3.1000	0.1300	0.4030	(28b)
Wall (cavity)	187.3000	33.1000	154.2000	0.1800	27.7560	(29a)
Roof (loft)	66.9000		66.9000	0.1100	7.3590	(30)
Total net area of external elements Aum(A, m2)			322.8000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.6292	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 90.2122 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.0000	0.0500	1.4500
E3 Sill	20.8000	0.0500	1.0400
E4 Jamb	45.2000	0.0500	2.2600
E5 Ground floor (normal)	36.8000	0.1600	5.8880
E6 Intermediate floor within a dwelling	31.8000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	21.9000	0.0600	1.3140
E12 Gable (insulation at ceiling level)	18.8000	0.0600	1.1280
E13 Gable (insulation at rafter level)	0.0000	0.0800	0.0000
E16 Corner (normal)	40.7000	0.0900	3.6630
R1 Head of roof window	0.0000	0.0800	0.0000
R2 Sill of roof window	0.0000	0.0600	0.0000
R3 Jamb of roof window	0.0000	0.0800	0.0000
E20 Exposed floor (normal)	5.2000	0.3200	1.6640

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.4070 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 100.0362 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	66.1469	65.7386	65.3384	63.4585	63.1067	61.4694	61.4694	61.1662	62.1001	63.1067	63.8183	64.5622 (38)
Average = Sum(39)m / 12 =	166.1831	165.7748	165.3746	163.4946	163.1429	161.5056	161.5056	161.2024	162.1363	163.1429	163.8545	164.5983 (39)
												163.4930
HLP	1.2552	1.2521	1.2491	1.2349	1.2322	1.2198	1.2198	1.2175	1.2246	1.2322	1.2376	1.2432 (40)
HLP (average)												1.2348
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

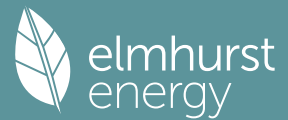
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9010 (42)
Hot water usage for mixer showers	72.8593	71.7644	70.1688	67.1161	64.8632	62.3508	60.9228	62.5062	64.2420	66.9395	70.0579	72.5801 (42a)	
Hot water usage for baths	31.4551	30.9879	30.3301	29.1171	28.2089	27.2018	26.6578	27.3111	28.0223	29.1000	30.3379	31.3488 (42b)	
Hot water usage for other uses	44.3387	42.7264	41.1140	39.5017	37.8894	36.2771	36.2771	37.8894	39.5017	41.1140	42.7264	44.3387 (42c)	
Average daily hot water use (litres/day)												136.6455 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.6531	145.4787	141.6130	135.7349	130.9615	125.8297	123.8577	127.7067	131.7661	137.1535	143.1221	148.2676 (44)	
Energy content (annual)	235.4301	207.1597	217.6538	185.8143	176.2994	154.7223	149.7952	158.1276	162.4807	186.1161	203.9037	232.1512 (45)	
Distribution loss (46)m = 0.15 x (45)m	35.3145	31.0740	32.6481	27.8721	26.4449	23.2083	22.4693	23.7191	24.3721	27.9174	30.5856	34.8227 (46)	
Water storage loss:													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.7527 (55)	
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)	
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	282.0250	249.2454	264.2488	230.9062	222.8943	199.8142	196.3901	204.7225	207.5726	232.7110	248.9955	278.7461 (62)	
WWHRS	-33.3082	-29.4581	-30.8468	-25.5424	-23.8046	-20.3697	-19.0934	-20.3039	-21.0753	-24.8455	-28.1469	-32.6914 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	248.7168	219.7873	233.4020	205.3638	199.0897	179.4444	177.2967	184.4186	186.4973	207.8655	220.8486	246.0547 (64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2508.7853 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
												0.0000 (64a)	
Heat gains from water heating, kWh/month	115.5564	102.5492	109.6458	97.8567	95.8955	87.5186	87.0828	89.8533	90.0983	99.1595	103.8715	114.4662 (65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	151.6134	167.8577	151.6134	156.6672	151.6134	156.6672	151.6134	151.6134	156.6672	151.6134	156.6672	151.6134 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.5905	303.7097	295.8494	279.1159	257.9927	238.1400	224.8772	221.7580	229.6182	246.3518	267.4749	287.3276 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382 (71)
Water heating gains (Table 5)	155.3178	152.6029	147.3734	135.9121	128.8917	121.5537	117.0468	120.7706	125.1366	133.2789	144.2659	153.8524 (72)
Total internal gains	677.0359	693.6845	664.3505	641.2094	608.0122	582.8751	560.0516	560.6563	577.9362	600.7584	637.9222	662.3077 (73)

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6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W

North					7.5000	10.6334	0.6300	0.7000			0.7700	24.3728 (74)
East					3.4800	19.6403	0.6300	0.7000			0.7700	20.8881 (76)
South					19.3900	46.7521	0.6300	0.7000			0.7700	277.0451 (78)
West					0.6300	19.6403	0.6300	0.7000			0.7700	3.7815 (80)

Solar gains	326.0874	548.5649	736.5917	896.2712	994.0152	983.8382	949.6687	876.3056	791.3507	602.0964	389.2199	279.9978 (83)
Total gains	1003.1233	1242.2494	1400.9422	1537.4807	1602.0274	1566.7133	1509.7203	1436.9619	1369.2869	1202.8548	1027.1421	942.3055 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.9648	20.0139	20.0624	20.2931	20.3368	20.5430	20.5430	20.5816	20.4631	20.3368	20.2485	20.1570
alpha	2.3310	2.3343	2.3375	2.3529	2.3558	2.3695	2.3695	2.3721	2.3642	2.3558	2.3499	2.3438
util living area	0.9384	0.9027	0.8580	0.7842	0.6827	0.5486	0.4253	0.4578	0.6291	0.8110	0.9092	0.9456 (86)
MIT	18.1105	18.5591	19.1117	19.7739	20.3272	20.7221	20.8907	20.8663	20.5901	19.8544	18.8696	18.0346 (87)
Th 2	19.8761	19.8786	19.8810	19.8922	19.8943	19.9042	19.9042	19.9060	19.9004	19.8943	19.8901	19.8856 (88)
util rest of house	0.9298	0.8898	0.8389	0.7543	0.6363	0.4786	0.3334	0.3661	0.5635	0.7783	0.8949	0.9381 (89)
MIT 2	16.5286	17.0902	17.7787	18.5942	19.2473	19.6854	19.8422	19.8257	19.5552	18.7118	17.4966	16.4383 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.8118	17.3532	18.0173	18.8054	19.4406	19.8710	20.0299	20.0120	19.7404	18.9163	17.7424	16.7240 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.8118	17.3532	18.0173	18.8054	19.4406	19.8710	20.0299	20.0120	19.7404	18.9163	17.7424	16.7240 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8962	0.8509	0.7988	0.7198	0.6150	0.4763	0.3446	0.3755	0.5529	0.7430	0.8573	0.9065 (94)
Useful gains	899.0006	1057.0253	1119.1427	1106.6115	985.2433	746.2332	520.2004	539.6064	757.0633	893.7218	880.5510	854.2064 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2079.2420	2064.4191	1904.6759	1619.4797	1262.8243	851.2960	553.9475	582.2646	914.5198	1356.7449	1743.8000	2061.4360 (97)
Space heating kWh	878.0996	676.9686	584.4368	369.2651	206.5203	0.0000	0.0000	0.0000	0.0000	344.4892	621.5393	898.1788 (98a)
Space heating requirement - total per year (kWh/year)	4579.4977											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	878.0996	676.9686	584.4368	369.2651	206.5203	0.0000	0.0000	0.0000	0.0000	344.4892	621.5393	898.1788 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4579.4977											
Space heating per m2	(98c) / (4) = 34.5884 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	878.0996	676.9686	584.4368	369.2651	206.5203	0.0000	0.0000	0.0000	0.0000	344.4892	621.5393	898.1788 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	951.3538	733.4438	633.1926	400.0706	223.7490	0.0000	0.0000	0.0000	0.0000	373.2277	673.3903	973.1082 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	248.7168	219.7873	233.4020	205.3638	199.0897	179.4444	177.2967	184.4186	186.4973	207.8655	220.8486	246.0547 (64)
Efficiency of water heater (217)m	86.6431	86.4114	86.0309	85.3595	84.1421	79.8000	79.8000	79.8000	79.8000	85.1845	86.2498	79.8000 (216)
Fuel for water heating, kWh/month	287.0589	254.3498	271.3000	240.5871	236.6114	224.8677	222.1763	231.1010	233.7058	244.0179	256.0571	283.8087 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	31.5023	25.2723	22.7549	16.6712	12.8773	10.5209	11.7471	15.2694	19.8334	26.0225	29.3923	32.3778 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-58.1241	-80.3827	-113.3445	-124.8916	-132.4910	-122.7933	-121.1496	-115.3427	-104.9059	-90.5700	-63.2909	-50.4261 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-37.7808	-78.8508	-155.6241	-232.2163	-305.6610	-306.7120	-303.2175	-257.4689	-189.6204	-112.3933	-50.3095	-29.9346 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4961.5360	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2985.6417	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												254.2413	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3237.5016	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5049.9173	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4961.5360	0.2100	1041.9226	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2985.6417	0.2100	626.9847	(264)
Space and water heating			1668.9073	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	254.2413	0.1443	36.6949	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1177.7124	0.1350	-159.0191	
PV Unit electricity exported	-2059.7893	0.1261	-259.7003	
Total			-418.7194	(269)
Total CO2, kg/year			1298.8121	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.8100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4961.5360	1.1300	5606.5356	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2985.6417	1.1300	3373.7751	(278)
Space and water heating			8980.3107	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	254.2413	1.5338	389.9638	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1177.7124	1.4990	-1765.4487	
PV Unit electricity exported	-2059.7893	0.4628	-953.2946	
Total			-2718.7433	(283)
Total Primary energy kWh/year			6781.6320	(286)
Target Primary Energy Rate (TPER)			51.2200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF FABRIC ENERGY EFFICIENCY

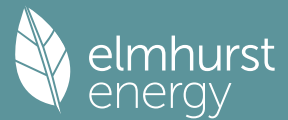
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	65.5000 (1b)	x 2.4000 (2b)	= 157.2000 (1b) - (3b)	
First floor	66.9000 (1c)	x 2.6900 (2c)	= 179.9610 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.4000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 337.1610 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1186 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3686 (18)
Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3410 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4348	0.4262	0.4177	0.3751	0.3666	0.3239	0.3239	0.3154	0.3410	0.3666	0.3836	0.4007	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													(23c)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5803	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1000	0.9000	1.8900			(26a)
Windows			19.6000	1.1450	22.4427			(27)
French Doors			15.1000	1.1450	17.2901			(27)
Ground Floor			65.5000	0.1200	7.8600	75.0000	4912.5000	(28a)
Exposed Floor			3.1000	0.2000	0.6200	20.0000	62.0000	(28b)
Wall (cavity)	187.3000	36.8000	150.5000	0.1800	27.0900	18.0000	2709.0000	(29a)
Roof (loft)	66.9000		66.9000	0.1100	7.3590	9.0000	602.1000	(30)
Total net area of external elements Aum(A, m2)			322.8000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 84.5518			(33)
Main dwelling								
Internal Wall			210.0000			9.0000	1890.0000	(32c)
Internal Floor			65.5000			18.0000	1179.0000	(32d)
Internal Ceiling			65.5000			9.0000	589.5000	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 11944.1000 (34)
List of Thermal Bridges 90.2122 (35)

	Length	Psi-value	Total	
K1 Element	29.0000	0.1440	4.1760	
E2 Other lintels (including other steel lintels)	20.8000	0.0480	0.9984	
E3 Sill	45.2000	0.0640	2.8928	
E4 Jamb	36.8000	0.0510	1.8768	
E5 Ground floor (normal)	31.8000	0.1300	4.1340	
E6 Intermediate floor within a dwelling	21.9000	0.0750	1.6425	
E10 Eaves (insulation at ceiling level)	18.8000	0.0620	1.1656	
E12 Gable (insulation at ceiling level)	0.0000	0.0620	0.0000	
E13 Gable (insulation at rafter level)	40.7000	0.0620	2.5234	
E16 Corner (normal)	0.0000	0.2400	0.0000	
R1 Head of roof window	0.0000	0.2400	0.0000	
R2 Sill of roof window	0.0000	0.2400	0.0000	
R3 Jamb of roof window	0.0000	0.2400	0.0000	
E20 Exposed floor (normal)	5.2000	0.3200	1.6640	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.0735 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 105.6253 (37)

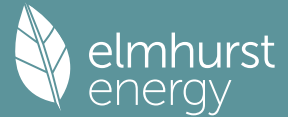
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
66.1469 65.7386 65.3384 63.4585 63.1067 61.4694 61.4694 61.1662 62.1001 63.1067 63.8183 64.5622 (38)
Heat transfer coeff 171.7723 171.3639 170.9637 169.0838 168.7321 167.0947 167.0947 166.7915 167.7254 168.7321 169.4436 170.1875 (39)
Average = Sum(39)m / 12 = 169.0821

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2974	1.2943	1.2913	1.2771	1.2744	1.2620	1.2620	1.2598	1.2668	1.2744	1.2798	1.2854	(40)
HLP (average)												1.2771	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9010 (42)
Hot water usage for mixer showers													(42a)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
Hot water usage for baths													(42b)
31.4551 30.9879 30.3301 29.1171 28.2089 27.2018 26.6578 27.3111 28.0223 29.1000 30.3379 31.3488													
Hot water usage for other uses													(42c)
44.3387 42.7264 41.1140 39.5017 37.8894 36.2771 36.2771 37.8894 39.5017 41.1140 42.7264 44.3387													
Average daily hot water use (litres/day)													(43)
Daily hot water use	75.7938	73.7143	71.4441	68.6189	66.0983	63.4789	62.9349	65.2005	67.5240	70.2140	73.0642	75.6874	(44)
Energy conte 120.0388 104.9682 109.8070 93.9358 88.9810 78.0547 76.1143 80.7318 83.2639 95.2797 104.0934 118.5082 (45)													
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													(46)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
Water storage loss:													
Total storage loss	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)												
If cylinder contains dedicated solar storage													(57)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)													
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)													
Total heat required for water heating calculated for each month													
102.0330 89.2230 93.3359 79.8454 75.6339 66.3465 64.6972 68.6220 70.7743 80.9878 88.4794 100.7320 (62)													
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)													
PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)													
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)													
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)													
Output from w/h	102.0330 89.2230 93.3359 79.8454 75.6339 66.3465 64.6972 68.6220 70.7743 80.9878 88.4794 100.7320 (64)												

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12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											980.7103 (64)
Electric shower(s)	981 (64)											
58.3481	51.9887	56.7696	54.1746	55.1911	52.6470	54.4019	55.1911	54.1746	56.7696	55.7022	58.3481 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											663.7068 (64a)	
Heat gains from water heating, kWh/month												
40.0953	35.3029	37.5264	33.5050	32.7063	29.7484	29.7748	30.9533	31.2372	34.4394	36.0454	39.7700 (65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	151.6134	167.8577	151.6134	156.6672	151.6134	156.6672	151.6134	151.6134	156.6672	151.6134	156.6672	151.6134	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.5905	303.7097	295.8494	279.1159	257.9927	238.1400	224.8772	221.7580	229.6182	246.3518	267.4749	287.3276	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	(71)
Water heating gains (Table 5)	53.8915	52.5341	50.4387	46.5347	43.9600	41.3172	40.0198	41.6039	43.3850	46.2895	50.0630	53.4543	(72)
Total internal gains	572.6097	590.6157	564.4158	548.8320	520.0804	502.6387	483.0247	481.4895	496.1847	510.7689	540.7194	558.9096	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.4000	10.6334	0.6300	0.0000	0.7700	43.3294	(74)
East	3.9000	19.6403	0.6300	0.0000	0.7700	37.1572	(76)
South	6.6000	46.7521	0.6300	0.0000	0.7700	149.6842	(78)
West	0.7000	19.6403	0.6300	0.0000	0.7700	6.6692	(80)
South	15.1000	46.7521	0.6300	0.0000	0.7700	342.4593	(78)

Solar gains	579.2994	974.5428	1308.6033	1592.3294	1766.0264	1747.9650	1687.2485	1556.8748	1405.9011	1069.6499	691.4568	497.4196	(83)
Total gains	1151.9090	1565.1586	1873.0191	2141.1615	2286.1068	2250.6036	2170.2732	2038.3644	1902.0858	1580.4188	1232.1761	1056.3292	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.3151	19.3612	19.4065	19.6223	19.6632	19.8558	19.8558	19.8919	19.7812	19.6632	19.5806	19.4950
alpha	2.2877	2.2907	2.2938	2.3082	2.3109	2.3237	2.3237	2.3261	2.3187	2.3109	2.3054	2.2997
util living area	0.9219	0.8603	0.7868	0.6817	0.5597	0.4268	0.3201	0.3512	0.5152	0.7336	0.8787	0.9337 (86)
MIT	18.1955	18.8050	19.4361	20.0834	20.5469	20.8290	20.9365	20.9193	20.7219	20.0682	19.0123	18.0804 (87)
Th 2	19.8429	19.8453	19.8477	19.8588	19.8609	19.8707	19.8707	19.8725	19.8669	19.8609	19.8567	19.8523 (88)
util rest of house	0.9113	0.8431	0.7618	0.6459	0.5111	0.3632	0.2441	0.2731	0.4502	0.6940	0.8606	0.9245 (89)
MIT 2	17.3280	17.9160	18.5173	19.1241	19.5344	19.7711	19.8443	19.8370	19.6930	19.1320	18.1368	17.2222 (90)
Living area fraction	fLA = Living area / (4) = 0.1790 (91)											
MIT	17.4833	18.0752	18.6818	19.2958	19.7156	19.9604	20.0398	20.0308	19.8772	19.2996	18.2935	17.3758 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.4833	18.0752	18.6818	19.2958	19.7156	19.9604	20.0398	20.0308	19.8772	19.2996	18.2935	17.3758 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8826	0.8108	0.7324	0.6265	0.5045	0.3684	0.2559	0.2845	0.4509	0.6718	0.8294	0.8978	(94)
Useful gains	1016.6918	1269.0507	1371.8252	1341.3670	1153.2304	829.2083	555.2648	579.8360	857.6029	1061.7289	1021.9341	948.3722	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2264.5173	2257.7458	2082.6438	1757.7603	1352.4968	895.7010	574.7786	605.5801	968.9776	1467.9001	1896.6637	2242.3540	(97)
Space heating kWh	928.3822	664.4032	528.8491	299.8032	148.2542	0.0000	0.0000	0.0000	0.0000	302.1914	629.8053	962.7224	(98a)
Space heating requirement - total per year (kWh/year)												4464.4109	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	928.3822	664.4032	528.8491	299.8032	148.2542	0.0000	0.0000	0.0000	0.0000	302.1914	629.8053	962.7224	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4464.4109	
Space heating per m2												33.7191 (99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1570.6904	1236.5009	1267.6155	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8459	0.8892	0.8720	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1328.6420	1099.5290	1105.3572	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2566.4173	2475.4257	2324.2673	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	891.1982	1023.6672	906.8691	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction	fc = cooled area / (4) =											1.0000	(105)

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Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	222.7996	255.9168	226.7173	0.0000	0.0000	0.0000 (107)
Space cooling requirement											705.4336 (107)
Energy for space heating											33.7191 (99)
Energy for space cooling											5.3280 (108)
Total											39.0472 (109)
Fabric Energy Efficiency (DFEE)											39.0 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	65.5000 (1b)	x 2.4000 (2b)	= 157.2000 (1b) - (3b)
First floor	66.9000 (1c)	x 2.6900 (2c)	= 179.9610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	337.1610 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1186 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3686 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3410 (21)

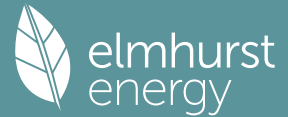
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4348	0.4262	0.4177	0.3751	0.3666	0.3239	0.3239	0.3154	0.3410	0.3666	0.3836	0.4007 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5803 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
TER Semi-glazed door			2.1000	1.0000	2.1000		(26a)
TER Opening Type			31.0000	1.1450	35.4962		(27)
Ground Floor			65.5000	0.1300	8.5150		(28a)
Exposed Floor			3.1000	0.1300	0.4030		(28b)
Wall (cavity)	187.3000	33.1000	154.2000	0.1800	27.7560		(29a)
Roof (loft)	66.9000		66.9000	0.1100	7.3590		(30)
Total net area of external elements A _{um} (A, m ²)			322.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.6292		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							90.2122 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				29.0000	0.0500	1.4500	
E3 Sill				20.8000	0.0500	1.0400	
E4 Jamb				45.2000	0.0500	2.2600	
E5 Ground floor (normal)				36.8000	0.1600	5.8880	
E6 Intermediate floor within a dwelling				31.8000	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)				21.9000	0.0600	1.3140	
E12 Gable (insulation at ceiling level)				18.8000	0.0600	1.1280	
E13 Gable (insulation at rafter level)				0.0000	0.0800	0.0000	
E16 Corner (normal)				40.7000	0.0900	3.6630	
R1 Head of roof window				0.0000	0.0800	0.0000	
R2 Sill of roof window				0.0000	0.0600	0.0000	
R3 Jamb of roof window				0.0000	0.0800	0.0000	
E20 Exposed floor (normal)				5.2000	0.3200	1.6640	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.4070 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	100.0362 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

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(38)m 66.1469 65.7386 65.3384 63.4585 63.1067 61.4694 61.4694 61.1662 62.1001 63.1067 63.8183 64.5622 (38)
 Heat transfer coeff 166.1831 165.7748 165.3746 163.4946 163.1429 161.5056 161.5056 161.2024 162.1363 163.1429 163.8545 164.5983 (39)
 Average = Sum(39)m / 12 = 163.4930

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2552	1.2521	1.2491	1.2349	1.2322	1.2198	1.2198	1.2175	1.2246	1.2322	1.2376	1.2432	(40)
HLP (average)												1.2348	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9010 (42)
 Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
 Hot water usage for baths 31.4551 30.9879 30.3301 29.1171 28.2089 27.2018 26.6578 27.3111 28.0223 29.1000 30.3379 31.3488 (42b)
 Hot water usage for other uses 44.3387 42.7264 41.1140 39.5017 37.8894 36.2771 36.2771 37.8894 39.5017 41.1140 42.7264 44.3387 (42c)
 Average daily hot water use (litres/day) 69.4717 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.7938	73.7143	71.4441	68.6189	66.0983	63.4789	62.9349	65.2005	67.5240	70.2140	73.0642	75.6874	(44)
Energy conte	120.0388	104.9682	109.8070	93.9358	88.9810	78.0547	76.1143	80.7318	83.2639	95.2797	104.0934	118.5082	(45)
Energy content (annual)										Total = Sum(45)m =		1153.7769	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
WWHRS	102.0330	89.2230	93.3359	79.8454	75.6339	66.3465	64.6972	68.6220	70.7743	80.9878	88.4794	100.7320	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	102.0330	89.2230	93.3359	79.8454	75.6339	66.3465	64.6972	68.6220	70.7743	80.9878	88.4794	100.7320	(64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				980.7103	(64a)
Electric shower(s)	58.3481	51.9887	56.7696	54.1746	55.1911	52.6470	54.4019	55.1911	54.1746	56.7696	55.7022	58.3481	(64a)
Heat gains from water heating, kWh/month	40.0953	35.3029	37.5264	33.5050	32.7063	29.7484	29.7748	30.9533	31.2372	34.4394	36.0454	39.7700	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	145.0477	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	151.6134	167.8577	151.6134	156.6672	151.6134	156.6672	151.6134	151.6134	156.6672	151.6134	156.6672	151.6134	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.5905	303.7097	295.8494	279.1159	257.9927	238.1400	224.8772	221.7580	229.6182	246.3518	267.4749	287.3276	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	37.5048	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	(71)
Water heating gains (Table 5)	53.8915	52.5341	50.4387	46.5347	43.9600	41.3172	40.0198	41.6039	43.3850	46.2895	50.0630	53.4543	(72)
Total internal gains	572.6097	590.6157	564.4158	548.8320	520.0804	502.6387	483.0247	481.4895	496.1847	510.7689	540.7194	558.9096	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g or Table 6c	FF or Table 6c	Access factor Table 6d	Gains W						
North	7.5000	10.6334	0.6300	0.7000	0.7700	24.3728	(74)						
East	3.4800	19.6403	0.6300	0.7000	0.7700	20.8881	(76)						
South	19.3900	46.7521	0.6300	0.7000	0.7700	277.0451	(78)						
West	0.6300	19.6403	0.6300	0.7000	0.7700	3.7815	(80)						
Solar gains	326.0874	548.5649	736.5917	896.2712	994.0152	983.8382	949.6687	876.3056	791.3507	602.0964	389.2199	279.9978	(83)
Total gains	898.6970	1139.1806	1301.0075	1445.1033	1514.0956	1486.4768	1432.6934	1357.7952	1287.5354	1112.8654	929.9392	838.9075	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
 Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9648	20.0139	20.0624	20.2931	20.3368	20.5430	20.5430	20.5816	20.4631	20.3368	20.2485	20.1570	
alpha	2.3310	2.3343	2.3375	2.3529	2.3558	2.3695	2.3695	2.3721	2.3642	2.3558	2.3499	2.3438	
util living area	0.9500	0.9166	0.8741	0.8023	0.7027	0.5685	0.4436	0.4783	0.6520	0.8317	0.9241	0.9567	(86)
MIT	17.9726	18.4372	19.0093	19.7004	20.2801	20.6991	20.8802	20.8529	20.5552	19.7751	18.7515	17.8945	(87)
Th 2	19.8761	19.8786	19.8810	19.8922	19.8943	19.9042	19.9042	19.9060	19.9004	19.8943	19.8901	19.8856	(88)
util rest of house													

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MIT 2	0.9429	0.9051	0.8566	0.7738	0.6572	0.4979	0.3491	0.3842	0.5868	0.8012	0.9118	0.9504 (89)
Living area fraction	17.1329	17.5884	18.1465	18.8148	19.3514	19.7182	19.8508	19.8365	19.6059	18.9021	17.9117	17.0620 (90)
MIT	17.2832	17.7404	18.3010	18.9734	19.5177	19.8938	20.0351	20.0184	19.7758	19.0584	18.0621	17.2110 (91)
Temperature adjustment												0.0000
adjusted MIT	17.2832	17.7404	18.3010	18.9734	19.5177	19.8938	20.0351	20.0184	19.7758	19.0584	18.0621	17.2110 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9199	0.8766	0.8258	0.7461	0.6398	0.4972	0.3611	0.3945	0.5786	0.7732	0.8846	0.9293 (94)	
Useful gains	826.7227	998.6395	1074.3576	1078.2240	968.7497	739.0504	517.3508	535.7065	744.9472	860.4773	822.6300	779.5911 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W	2157.5868	2128.6098	1951.5802	1646.9401	1275.3978	854.9825	554.7818	583.3003	920.2511	1379.9220	1796.1820	2141.5956 (97)	
Space heating kWh	990.1629	759.3400	652.6536	409.4756	228.1462	0.0000	0.0000	0.0000	0.0000	386.4669	700.9575	1013.3313 (98a)	
Space heating requirement - total per year (kWh/year)												5140.5340	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	990.1629	759.3400	652.6536	409.4756	228.1462	0.0000	0.0000	0.0000	0.0000	386.4669	700.9575	1013.3313 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												5140.5340	
Space heating per m2												(98c) / (4) =	38.8258 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1518.1524	1195.1413	1225.1380	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7366	0.7999	0.7767	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1118.2876	955.9410	951.5661	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1673.2821	1613.3194	1528.7968	0.0000	0.0000	0.0000	0.0000 (103)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	399.5960	489.0895	429.4596	0.0000	0.0000	0.0000	0.0000 (104)	
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)	
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	99.8990	122.2724	107.3649	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling requirement												329.5363 (107)	
Energy for space heating												38.8258 (99)	
Energy for space cooling												2.4889 (108)	
Total												41.3147 (109)	
Fabric Energy Efficiency (TFEE)												41.3 (109)	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

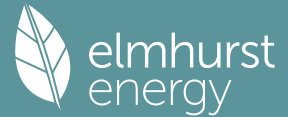
Main dwelling	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	65.5000 (1b)	x 2.4000 (2b)	= 157.2000 (1b) - (3b)	
First floor	66.9000 (1c)	x 2.6900 (2c)	= 179.9610 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.4000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	337.1610 (5)	

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1186 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000 (17)	
Infiltration rate		0.3686 (18)	
Number of sides sheltered		1 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3410 (21)	

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	

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Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4348	0.4262	0.4177	0.3751	0.3666	0.3239	0.3239	0.3154	0.3410	0.3666	0.3836	0.4007 (22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5803 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			19.6000	1.1450	22.4427		(27)
French Doors			15.1000	1.1450	17.2901		(27)
Ground Floor			65.5000	0.1200	7.8600	75.0000	4912.5000 (28a)
Exposed Floor			3.1000	0.2000	0.6200	20.0000	62.0000 (28b)
Wall (cavity)	187.3000	36.8000	150.5000	0.1800	27.0900	18.0000	2709.0000 (29a)
Roof (loft)	66.9000		66.9000	0.1100	7.3590	9.0000	602.1000 (30)
Total net area of external elements Aum(A, m2)			322.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.5518		(33)
Main dwelling							
Internal Wall			210.0000			9.0000	1890.0000 (32c)
Internal Floor			65.5000			18.0000	1179.0000 (32d)
Internal Ceiling			65.5000			9.0000	589.5000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11944.1000 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 90.2122 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.0000	0.1440	4.1760
E3 Sill	20.8000	0.0480	0.9984
E4 Jamb	45.2000	0.0640	2.8928
E5 Ground floor (normal)	36.8000	0.0510	1.8768
E6 Intermediate floor within a dwelling	31.8000	0.1300	4.1340
E10 Eaves (insulation at ceiling level)	21.9000	0.0750	1.6425
E12 Gable (insulation at ceiling level)	18.8000	0.0620	1.1656
E13 Gable (insulation at rafter level)	0.0000	0.0620	0.0000
E16 Corner (normal)	40.7000	0.0620	2.5234
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	5.2000	0.3200	1.6640

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.0735 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 105.6253 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	66.1469	65.7386	65.3384	63.4585	63.1067	61.4694	61.4694	61.1662	62.1001	63.1067	63.8183	64.5622 (38)
Average = Sum(39)m / 12 =	171.7723	171.3639	170.9637	169.0838	168.7321	167.0947	167.0947	166.7915	167.7254	168.7321	169.4436	170.1875 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2974	1.2943	1.2913	1.2771	1.2744	1.2620	1.2620	1.2598	1.2668	1.2744	1.2798	1.2854 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9010 (42)
Hot water usage for mixer showers												
81.9667	80.7349	78.9399	75.5056	72.9711	70.1447	68.5381	70.3195	72.2723	75.3070	78.8151	81.6527 (42a)	
Hot water usage for baths												
31.4551	30.9879	30.3301	29.1171	28.2089	27.2018	26.6578	27.3111	28.0223	29.1000	30.3379	31.3488 (42b)	
Hot water usage for other uses												
44.3387	42.7264	41.1140	39.5017	37.8894	36.2771	36.2771	37.8894	39.5017	41.1140	42.7264	44.3387 (42c)	
Average daily hot water use (litres/day)												145.0423 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	157.7605	154.4492	150.3841	144.1244	139.0694	133.6236	131.4730	135.5200	139.7963	145.5210	151.8794	157.3401 (44)
Energy conte	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (45)
Energy content (annual)												
										Total = Sum(45)m		2409.1387

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month												
	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

249.8540 219.9336 231.1347 197.2991 187.2141 164.3058 159.0053 167.8021 172.3828 197.4706 216.3800 246.3565 (64)

Total per year (kWh/year) = Sum(64)m = 2409.1387 (64)

Electric shower(s)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

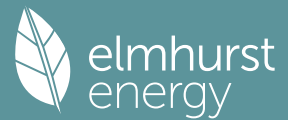
Heat gains from water heating, kWh/month

83.0765 73.1279 76.8523 65.6020 62.2487 54.6317 52.8692 55.7942 57.3173 65.6590 71.9463 81.9136 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572 (66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.8242	32.7069	26.5991	20.1372	15.0528	12.7082	13.7317	17.8489	23.9568	30.4187	35.5031	37.8477 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	448.6425	453.2980	441.5663	416.5908	385.0638	355.4329	335.6376	330.9821	342.7138	367.6892	399.2162	428.8472 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382 (71)
Water heating gains (Table 5)	111.6619	108.8213	103.2961	91.1138	83.6676	75.8773	71.0608	74.9922	79.6074	88.2513	99.9255	110.0989 (72)
Total internal gains	713.4544	711.1520	687.7872	644.1676	600.1100	557.3441	533.7558	537.1489	559.6037	602.6849	650.9705	693.1195 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				8.4000	10.6334		0.6300		0.0000		0.7700		43.3294 (74)
East				3.9000	19.6403		0.6300		0.0000		0.7700		37.1572 (76)
South				6.6000	46.7521		0.6300		0.0000		0.7700		149.6842 (78)
West				0.7000	19.6403		0.6300		0.0000		0.7700		6.6692 (80)
South				15.1000	46.7521		0.6300		0.0000		0.7700		342.4593 (78)
Solar gains	579.2994	974.5428	1308.6033	1592.3294	1766.0264	1747.9650	1687.2485	1556.8748	1405.9011	1069.6499	691.4568	497.4196	(83)
Total gains	1292.7537	1685.6948	1996.3905	2236.4971	2366.1363	2305.3091	2221.0043	2094.0237	1965.5048	1672.3348	1342.4273	1190.5391	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.3151	19.3612	19.4065	19.6223	19.6632	19.8558	19.8558	19.8919	19.7812	19.6632	19.5806	19.4950
alpha	2.2877	2.2907	2.2938	2.3082	2.3109	2.3237	2.3237	2.3261	2.3187	2.3109	2.3054	2.2997
util living area	0.9043	0.8432	0.7676	0.6661	0.5469	0.4186	0.3136	0.3431	0.5031	0.7146	0.8606	0.9176 (86)
MIT	18.8880	19.3078	19.7628	20.2156	20.5449	20.7457	20.8231	20.8113	20.6703	20.2110	19.4620	18.8018 (87)
Th 2	19.8429	19.8453	19.8477	19.8588	19.8609	19.8707	19.8707	19.8725	19.8669	19.8609	19.8567	19.8523 (88)
util rest of house	0.8919	0.8246	0.7415	0.6299	0.4984	0.3557	0.2389	0.2664	0.4388	0.6740	0.8406	0.9067 (89)
MIT 2	17.4062	17.9234	18.4769	19.0208	19.3938	19.6105	19.6780	19.6718	19.5397	19.0356	18.1341	17.3054 (90)
Living area fraction	fLA = Living area / (4) =											0.1790 (91)
MIT	17.6715	18.1712	18.7071	19.2347	19.5999	19.8137	19.8830	19.8758	19.7421	19.2460	18.3718	17.5733 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6715	18.1712	18.7071	19.2347	19.5999	19.8137	19.8830	19.8758	19.7421	19.2460	18.3718	17.5733 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8617	0.7921	0.7117	0.6081	0.4866	0.3524	0.2397	0.2666	0.4312	0.6491	0.8085	0.8782 (94)
Ext temp.	1113.9920	1335.1704	1420.8182	1359.9569	1151.2451	812.3785	532.3875	558.2939	847.4730	1085.4503	1085.3271	1045.5054 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	2296.8449	2274.2038	2086.9730	1747.4320	1332.9610	871.1757	548.5671	579.7301	946.3204	1458.8611	1909.9374	2275.9650 (97)
Space heating requirement - total per year (kWh/year)	880.0426	631.0305	495.6192	278.9821	135.1966	0.0000	0.0000	0.0000	0.0000	277.8176	593.7195	915.4619 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	880.0426	631.0305	495.6192	278.9821	135.1966	0.0000	0.0000	0.0000	0.0000	277.8176	593.7195	915.4619 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4207.8699
Space heating per m2												(98c) / (4) = 31.7815 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
efficiency (main heating system 1)	880.0426	631.0305	495.6192	278.9821	135.1966	0.0000	0.0000	0.0000	0.0000	277.8176	593.7195	915.4619 (98)
fuel (main heating system)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating efficiency (main heating system 2)	401.2962	287.7476	226.0006	127.2148	61.6492	0.0000	0.0000	0.0000	0.0000	126.6838	270.7339	417.4473 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	131.2259	115.5113	121.3943	103.6235	98.3268	86.2950	83.5112	88.1313	90.5372	103.7135	113.6449	129.3889 (219)

Full SAP Calculation Printout



Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	32.2320	25.8577	23.2820	17.0574	13.1756	10.7646	12.0192	15.6231	20.2928	26.6253	30.0732	33.1278		(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													1918.7733	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													190.4000	
Water heating fuel used													1265.3039	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													260.1308	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													3444.2080	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1918.7733	16.4900	316.4057	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1265.3039	16.4900	208.6486	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	260.1308	16.4900	42.8956	(250)
Additional standing charges			0.0000	(251)
Total energy cost			567.9499	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1525	(257)
SAP value		81.3172	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

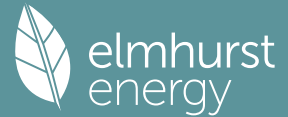
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1918.7733	0.1556	298.5121	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1265.3039	0.1416	179.1395	(264)
Space and water heating			477.6516	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	260.1308	0.1443	37.5449	(268)
Total CO2, kg/year			515.1965	(272)
CO2 emissions per m2			3.8900	(273)
EI value			96.1084	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	65.5000 (1b)	x 2.4000 (2b)	= 157.2000 (1b) - (3b)	
First floor	66.9000 (1c)	x 2.6900 (2c)	= 179.9610 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.4000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	337.1610 (5)	

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2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												4 * 10 = 40.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) = 0.1186 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.3686 (18)
Number of sides sheltered												1 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3410 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Adj infilt rate	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
	0.4092	0.3836	0.3751	0.3325	0.3325	0.3069	0.3154	0.2984	0.3154	0.3410	0.3495	0.3751 (22b)
Effective ac	0.5837	0.5736	0.5703	0.5553	0.5553	0.5471	0.5497	0.5445	0.5497	0.5581	0.5611	0.5703 (25)

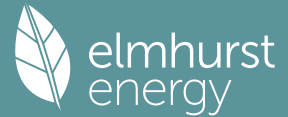
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Main dwelling												
Front Door			2.1000	0.9000	1.8900			(26a)				
Windows			19.6000	1.1450	22.4427			(27)				
French Doors			15.1000	1.1450	17.2901			(27)				
Ground Floor			65.5000	0.1200	7.8600	75.0000	4912.5000	(28a)				
Exposed Floor			3.1000	0.2000	0.6200	20.0000	62.0000	(28b)				
Wall (cavity)	187.3000	36.8000	150.5000	0.1800	27.0900	18.0000	2709.0000	(29a)				
Roof (loft)	66.9000		66.9000	0.1100	7.3590	9.0000	602.1000	(30)				
Total net area of external elements Aum(A, m2)			322.8000					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.5518			(33)				
Main dwelling												
Internal Wall			210.0000			9.0000	1890.0000	(32c)				
Internal Floor			65.5000			18.0000	1179.0000	(32d)				
Internal Ceiling			65.5000			9.0000	589.5000	(32e)				
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11944.1000	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							90.2122	(35)				
List of Thermal Bridges												
K1 Element				Length	Psi-value		Total					
E2 Other lintels (including other steel lintels)				29.0000	0.1440		4.1760					
E3 Sill				20.8000	0.0480		0.9984					
E4 Jamb				45.2000	0.0640		2.8928					
E5 Ground floor (normal)				36.8000	0.0510		1.8768					
E6 Intermediate floor within a dwelling				31.8000	0.1300		4.1340					
E10 Eaves (insulation at ceiling level)				21.9000	0.0750		1.6425					
E12 Gable (insulation at ceiling level)				18.8000	0.0620		1.1656					
E13 Gable (insulation at rafter level)				0.0000	0.0620		0.0000					
E16 Corner (normal)				40.7000	0.0620		2.5234					
R1 Head of roof window				0.0000	0.2400		0.0000					
R2 Sill of roof window				0.0000	0.2400		0.0000					
R3 Jamb of roof window				0.0000	0.2400		0.0000					
E20 Exposed floor (normal)				5.2000	0.3200		1.6640					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.0735	(36)				
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	105.6253	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 64.9462	Feb 63.8183	Mar 63.4585	Apr 61.7807	May 61.7807	Jun 60.8711	Jul 61.1662	Aug 60.5840	Sep 61.1662	Oct 62.1001	Nov 62.4275	Dec 63.4585 (38)
Heat transfer coeff	170.5715	169.4436	169.0838	167.4060	167.4060	166.4964	166.7915	166.2093	166.7915	167.7254	168.0529	169.0838 (39)
Average = Sum(39)m / 12 =												167.9218
HLP	Jan 1.2883	Feb 1.2798	Mar 1.2771	Apr 1.2644	May 1.2644	Jun 1.2575	Jul 1.2598	Aug 1.2554	Sep 1.2598	Oct 1.2668	Nov 1.2693	Dec 1.2771 (40)
HLP (average)												1.2683
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9010 (42)
Hot water usage for mixer showers	81.9667	80.7349	78.9399	75.5056	72.9711	70.1447	68.5381	70.3195	72.2723	75.3070	78.8151	81.6527 (42a)
Hot water usage for baths	31.4551	30.9879	30.3301	29.1171	28.2089	27.2018	26.6578	27.3111	28.0223	29.1000	30.3379	31.3488 (42b)
Hot water usage for other uses	44.3387	42.7264	41.1140	39.5017	37.8894	36.2771	36.2771	37.8894	39.5017	41.1140	42.7264	44.3387 (42c)
Average daily hot water use (litres/day)												145.0423 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	157.7605	154.4492	150.3841	144.1244	139.0694	133.6236	131.4730	135.5200	139.7963	145.5210	151.8794	157.3401 (44)
Energy conte	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (45)

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Energy content (annual)											Total = Sum(45)m =	2409.1387
Distribution loss (46)m = 0.15 x (45)m												
	37.4781	32.9900	34.6702	29.5949	28.0821	24.6459	23.8508	25.1703	25.8574	29.6206	32.4570	36.9535 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (64)
											Total per year (kWh/year) = Sum(64)m =	2409.1387 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)
Heat gains from water heating, kWh/month												
	83.0765	73.1279	76.8523	65.6020	62.2487	54.6317	52.8692	55.7942	57.3173	65.6590	71.9463	81.9136 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	36.8242	32.7069	26.5991	20.1372	15.0528	12.7082	13.7317	17.8489	23.9568	30.4187	35.5031	37.8477	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	448.6425	453.2980	441.5663	416.5908	385.0638	355.4329	335.6376	330.9821	342.7138	367.6892	399.2162	428.8472	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	(71)
Water heating gains (Table 5)													
	111.6619	108.8213	103.2961	91.1138	83.6676	75.8773	71.0608	74.9922	79.6074	88.2513	99.9255	110.0989	(72)
Total internal gains	713.4544	711.1520	687.7872	644.1676	600.1100	557.3441	533.7558	537.1489	559.6037	602.6849	650.9705	693.1195	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.4000	12.7054	0.6300	0.0000	0.7700	51.7724	(74)
East	3.9000	23.7288	0.6300	0.0000	0.7700	44.8923	(76)
South	6.6000	53.5774	0.6300	0.0000	0.7700	171.5365	(78)
West	0.7000	23.7288	0.6300	0.0000	0.7700	8.0576	(80)
South	15.1000	53.5774	0.6300	0.0000	0.7700	392.4547	(78)

Solar gains	668.7134	999.5151	1339.5063	1728.6993	1856.8661	1971.3708	1877.9489	1738.5753	1543.7620	1173.3779	805.7085	555.5349	(83)
Total gains	1382.1678	1710.6671	2027.2935	2372.8669	2456.9760	2528.7149	2411.7047	2275.7242	2103.3657	1776.0629	1456.6790	1248.6544	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.4511	19.5806	19.6223	19.8189	19.8189	19.9272	19.8919	19.9616	19.8919	19.7812	19.7426	19.6223
alpha	2.2967	2.3054	2.3082	2.3213	2.3213	2.3285	2.3261	2.3308	2.3261	2.3187	2.3162	2.3082
util living area	0.8843	0.8304	0.7474	0.6231	0.4929	0.3451	0.2415	0.2476	0.4274	0.6522	0.8217	0.8999 (86)
MIT	19.1072	19.4352	19.8887	20.3426	20.6386	20.7983	20.8477	20.8476	20.7487	20.3959	19.7266	19.0528 (87)
Th 2	19.8500	19.8567	19.8588	19.8688	19.8688	19.8743	19.8725	19.8760	19.8725	19.8669	19.8650	19.8588 (88)
util rest of house	0.8692	0.8103	0.7191	0.5844	0.4411	0.2823	0.1687	0.1711	0.3593	0.6040	0.7963	0.8863 (89)
MIT 2	17.6843	18.0884	18.6368	19.1724	19.4990	19.6590	19.6956	19.6996	19.6179	19.2496	18.4631	17.6252 (90)
Living area fraction	fLA = Living area / (4) =											0.1790 (91)
MIT	17.9390	18.3294	18.8609	19.3819	19.7030	19.8630	19.9018	19.9051	19.8203	19.4548	18.6892	17.8807 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9390	18.3294	18.8609	19.3819	19.7030	19.8630	19.9018	19.9051	19.8203	19.4548	18.6892	17.8807 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8377	0.7782	0.6910	0.5663	0.4331	0.2817	0.1706	0.1731	0.3560	0.5846	0.7648	0.8560	(94)
Useful gains	1157.8927	1331.1994	1400.7837	1343.7162	1064.0232	712.2437	411.4401	394.0096	748.6972	1038.2973	1114.0594	1068.8773	(95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Heat loss rate W													
	2207.0178	2190.8121	1988.5813	1654.2893	1189.0806	743.0690	417.2873	399.7469	803.9834	1300.6749	1779.5526	2144.1043	(97)
Space heating kWh													
	780.5491	577.6597	437.3214	223.6127	93.0427	0.0000	0.0000	0.0000	0.0000	195.2090	479.1551	799.9689	(98a)
Space heating requirement - total per year (kWh/year)													3586.5186
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)													0.0000
Space heating kWh													
	780.5491	577.6597	437.3214	223.6127	93.0427	0.0000	0.0000	0.0000	0.0000	195.2090	479.1551	799.9689	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													3586.5186
Space heating per m ²											(98c) / (4) =	27.0885	(99)

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												219.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	780.5491	577.6597	437.3214	223.6127	93.0427	0.0000	0.0000	0.0000	0.0000	195.2090	479.1551	799.9689	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	355.9275	263.4107	199.4170	101.9666	42.4271	0.0000	0.0000	0.0000	0.0000	89.0146	218.4930	364.7829	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	131.2259	115.5113	121.3943	103.6235	98.3268	86.2950	83.5112	88.1313	90.5372	103.7135	113.6449	129.3889	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	32.2320	25.8577	23.2820	17.0574	13.1756	10.7646	12.0192	15.6231	20.2928	26.6253	30.0732	33.1278	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1635.4394	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1265.3039	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												260.1308	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3160.8741	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1635.4394	26.0600	426.1955 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1265.3039	26.0600	329.7382 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	260.1308	26.0600	67.7901 (250)
Additional standing charges			0.0000 (251)
Total energy cost			823.7238 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1635.4394	0.1562	255.4123 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1265.3039	0.1416	179.1395 (264)
Space and water heating			434.5518 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	260.1308	0.1443	37.5449 (268)
Total CO2, kg/year			472.0967 (272)

13a. Primary energy - Individual heating systems including micro-CHP

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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1635.4394	1.5782	2580.9948	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1265.3039	1.5235	1927.7392	(278)
Space and water heating			4508.7340	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	260.1308	1.5338	398.9972	(282)
Total Primary energy kWh/year			4907.7312	(286)

SAP 10 EPC IMPROVEMENTS

DB0105

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 76	-37 kg (7.7%)
U Solar photovoltaic panels	+ 6.5	-£ 309	-248 kg (56.9%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£76	0.28 kg/m²	B 83 A 96
Solar photovoltaic panels	£309	1.87 kg/m²	B 89 A 98
Total Savings	£385	2.15 kg/m²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £824	Potential £748	Saving £76
Electricity			
Space heating	£426	£447	-£21
Water heating	£330	£233	£97
Lighting	£68	£68	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£824	£439	£385
Total cost of uses	£824	£439	£385
Delivered energy	24 kWh/m²	7 kWh/m²	17 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.2 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	1 kg/m²	2 kg/m²
Primary energy	37 kWh/m²	20 kWh/m²	17 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

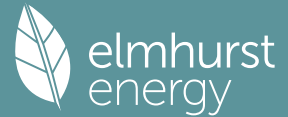
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	65.5000 (1b)	x 2.4000 (2b)	= 157.2000 (1b) - (3b)
First floor	66.9000 (1c)	x 2.6900 (2c)	= 179.9610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 337.1610 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	40.0000 / (5) = 0.1186 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3686 (18)
Number of sides sheltered	1 (19)

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Shelter factor
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$
$$(21) = (18) \times (20) = 0.3410 \quad (21)$$

Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4348	0.4262	0.4177	0.3751	0.3666	0.3239	0.3239	0.3154	0.3410	0.3666	0.3836	0.4007 (22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5803 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1000	0.9000	1.8900			(26a)
Windows			19.6000	1.1450	22.4427			(27)
French Doors			15.1000	1.1450	17.2901			(27)
Ground Floor			65.5000	0.1200	7.8600	75.0000	4912.5000	(28a)
Exposed Floor			3.1000	0.2000	0.6200	20.0000	62.0000	(28b)
Wall (cavity)	187.3000	36.8000	150.5000	0.1800	27.0900	18.0000	2709.0000	(29a)
Roof (loft)	66.9000		66.9000	0.1100	7.3590	9.0000	602.1000	(30)
Total net area of external elements Aum(A, m2)			322.8000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	84.5518		(33)
Main dwelling								
Internal Wall			210.0000			9.0000	1890.0000	(32c)
Internal Floor			65.5000			18.0000	1179.0000	(32d)
Internal Ceiling			65.5000			9.0000	589.5000	(32e)

Heat capacity Cm = Sum(A x k)

$$(28)...(30) + (32) + (32a)...(32e) = 11944.1000 \quad (34)$$

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

$$90.2122 \quad (35)$$

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.0000	0.1440	4.1760
E3 Sill	20.8000	0.0480	0.9984
E4 Jamb	45.2000	0.0640	2.8928
E5 Ground floor (normal)	36.8000	0.0510	1.8768
E6 Intermediate floor within a dwelling	31.8000	0.1300	4.1340
E10 Eaves (insulation at ceiling level)	21.9000	0.0750	1.6425
E12 Gable (insulation at ceiling level)	18.8000	0.0620	1.1656
E13 Gable (insulation at rafter level)	0.0000	0.0620	0.0000
E16 Corner (normal)	40.7000	0.0620	2.5234
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	5.2000	0.3200	1.6640

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

$$21.0735 \quad (36)$$

Point Thermal bridges

$$(36a) = 0.0000$$

Total fabric heat loss

$$(33) + (36) + (36a) = 105.6253 \quad (37)$$

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 66.1469	Feb 65.7386	Mar 65.3384	Apr 63.4585	May 63.1067	Jun 61.4694	Jul 61.4694	Aug 61.1662	Sep 62.1001	Oct 63.1067	Nov 63.8183	Dec 64.5622 (38)
Heat transfer coeff	171.7723	171.3639	170.9637	169.0838	168.7321	167.0947	167.0947	166.7915	167.7254	168.7321	169.4436	170.1875 (39)
Average = Sum(39)m / 12 =												169.0821

HLP	Jan 1.2974	Feb 1.2943	Mar 1.2913	Apr 1.2771	May 1.2744	Jun 1.2620	Jul 1.2620	Aug 1.2598	Sep 1.2668	Oct 1.2744	Nov 1.2798	Dec 1.2854 (40)
HLP (average)												1.2771
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

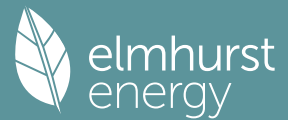
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9010 (42)
Hot water usage for mixer showers	81.9667	80.7349	78.9399	75.5056	72.9711	70.1447	68.5381	70.3195	72.2723	75.3070	78.8151	81.6527 (42a)
Hot water usage for baths	31.4551	30.9879	30.3301	29.1171	28.2089	27.2018	26.6578	27.3111	28.0223	29.1000	30.3379	31.3488 (42b)
Hot water usage for other uses	44.3387	42.7264	41.1140	39.5017	37.8894	36.2771	36.2771	37.8894	39.5017	41.1140	42.7264	44.3387 (42c)
Average daily hot water use (litres/day)	37.4781	32.9900	34.6702	29.5949	28.0821	24.6459	23.8508	25.1703	25.8574	29.6206	32.4570	36.9535 (46)

Daily hot water use	Jan 157.7605	Feb 154.4492	Mar 150.3841	Apr 144.1244	May 139.0694	Jun 133.6236	Jul 131.4730	Aug 135.5200	Sep 139.7963	Oct 145.5210	Nov 151.8794	Dec 157.3401 (44)
Energy conte	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (45)
Energy content (annual)										Total = Sum(45)m =		2409.1387
Distribution loss (46)m = 0.15 x (45)m	37.4781	32.9900	34.6702	29.5949	28.0821	24.6459	23.8508	25.1703	25.8574	29.6206	32.4570	36.9535 (46)

Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)

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Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												606.8173 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												606.8173
Solar input	-0.0000	-16.2295	-57.6725	-78.6565	-102.1970	-93.4609	-92.1992	-81.3515	-56.5099	-28.5403	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	249.8540	203.7041	173.4622	118.6426	85.0171	70.8449	66.8061	86.4506	115.8729	168.9303	216.3800	246.3565 (64)
	Total per year (kWh/year) = Sum(64)m =										1802.3214	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =										0.0000	(64a)
Heat gains from water heating, kWh/month	83.0765	73.1279	76.8523	65.6020	62.2487	54.6317	52.8692	55.7942	57.3173	65.6590	71.9463	81.9136 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	36.8242	32.7069	26.5991	20.1372	15.0528	12.7082	13.7317	17.8489	23.9568	30.4187	35.5031	37.8477 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	448.6425	453.2980	441.5663	416.5908	385.0638	355.4329	335.6376	330.9821	342.7138	367.6892	399.2162	428.8472 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382 (71)
Water heating gains (Table 5)												
	111.6619	108.8213	103.2961	91.1138	83.6676	75.8773	71.0608	74.9922	79.6074	88.2513	99.9255	110.0989 (72)
Total internal gains	713.4544	711.1520	687.7872	644.1676	600.1100	557.3441	533.7558	537.1489	559.6037	602.6849	650.9705	693.1195 (73)

6. Solar gains

[Jan]												

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	19.3151	19.3612	19.4065	19.6223	19.6632	19.8558	19.8558	19.8919	19.7812	19.6632	19.5806	19.4950
util living area	2.2877	2.2907	2.2938	2.3082	2.3109	2.3237	2.3237	2.3261	2.3187	2.3109	2.3054	2.2997
	0.9043	0.8432	0.7676	0.6661	0.5469	0.4186	0.3136	0.3431	0.5031	0.7146	0.8606	0.9176 (86)
MIT	18.8880	19.3078	19.7628	20.2156	20.5449	20.7457	20.8231	20.8113	20.6703	20.2110	19.4620	18.8018 (87)
Th 2	19.8429	19.8453	19.8477	19.8588	19.8609	19.8707	19.8707	19.8725	19.8669	19.8609	19.8567	19.8523 (88)
util rest of house												
	0.8919	0.8246	0.7415	0.6299	0.4984	0.3557	0.2389	0.2664	0.4388	0.6740	0.8406	0.9067 (89)
MIT 2	17.4062	17.9234	18.4769	19.0208	19.3938	19.6105	19.6780	19.6718	19.5397	19.0356	18.1341	17.3054 (90)
Living area fraction												
	17.6715	18.1712	18.7071	19.2347	19.5999	19.8137	19.8830	19.8758	19.7421	19.2460	18.3718	17.5733 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6715	18.1712	18.7071	19.2347	19.5999	19.8137	19.8830	19.8758	19.7421	19.2460	18.3718	17.5733 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8617	0.7921	0.7117	0.6081	0.4866	0.3524	0.2397	0.2666	0.4312	0.6491	0.8085	0.8782 (94)
Useful gains	1113.9920	1335.1704	1420.8182	1359.9569	1151.2451	812.3785	532.3875	558.2939	847.4730	1085.4503	1085.3271	1045.5054 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2296.8449	2274.2038	2086.9730	1747.4320	1332.9610	871.1757	548.5671	579.7301	946.3204	1458.8611	1909.9374	2275.9650 (97)
Space heating kWh	880.0426	631.0305	495.6192	278.9821	135.1966	0.0000	0.0000	0.0000	0.0000	277.8176	593.7195	915.4619 (98a)
Space heating requirement - total per year (kWh/year)												4207.8699
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	880.0426	631.0305	495.6192	278.9821	135.1966	0.0000	0.0000	0.0000	0.0000	277.8176	593.7195	915.4619 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4207.8699
Space heating per m ²												31.7815 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)

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Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	880.0426	631.0305	495.6192	278.9821	135.1966	0.0000	0.0000	0.0000	0.0000	277.8176	593.7195	915.4619 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	401.2962	287.7476	226.0006	127.2148	61.6492	0.0000	0.0000	0.0000	0.0000	126.6838	270.7339	417.4473 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	249.8540	203.7041	173.4622	118.6426	85.0171	70.8449	66.8061	86.4506	115.8729	168.9303	216.3800	246.3565 (64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	131.2259	106.9874	91.1041	62.3123	44.6518	37.2084	35.0872	45.4047	60.8576	88.7239	113.6449	129.3889 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	32.2320	25.8577	23.2820	17.0574	13.1756	10.7646	12.0192	15.6231	20.2928	26.6253	30.0732	33.1278 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-39.7314	-59.7794	-90.1258	-103.7891	-110.8603	-98.1097	-96.5627	-90.5290	-79.4050	-68.2362	-44.6430	-33.9271 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-10.3551	-23.8006	-52.2205	-86.9830	-124.8225	-133.6040	-132.0888	-109.2450	-77.0581	-38.6096	-14.7668	-7.9867 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1918.7733 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												946.5974 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												260.1308 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1727.2394 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												1478.2621 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1918.7733	16.4900	316.4057 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	946.5974	16.4900	156.0939 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	260.1308	16.4900	42.8956 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-915.6987	16.4900	-150.9987
PV Unit electricity exported	-811.5407	5.5900	-45.3651
Total			-196.3638 (252)
Total energy cost			332.2234 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.6742 (257)
SAP value		89.0715
SAP rating (Section 12)		89 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1918.7733	0.1556	298.5121 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	946.5974	0.1462	138.4383 (264)
Space and water heating			436.9504 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)

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Energy for lighting	260.1308	0.1443	37.5449 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-915.6987	0.1345	-123.1752
PV Unit electricity exported	-811.5407	0.1225	-99.4483
Total			-222.6235 (269)
Total CO ₂ , kg/year			262.9689 (272)
CO ₂ emissions per m ²			1.9900 (273)
EI value			98.0137
EI rating			98 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	65.5000 (1b)	x 2.4000 (2b)	= 157.2000 (1b) - (3b)
First floor	66.9000 (1c)	x 2.6900 (2c)	= 179.9610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	337.1610 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1186 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3686 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3410 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infiltr rate	0.4092	0.3836	0.3751	0.3325	0.3325	0.3069	0.3154	0.2984	0.3154	0.3410	0.3495	0.3751 (22b)
Effective ac	0.5837	0.5736	0.5703	0.5553	0.5553	0.5471	0.5497	0.5445	0.5497	0.5581	0.5611	0.5703 (25)

3. Heat losses and heat loss parameter

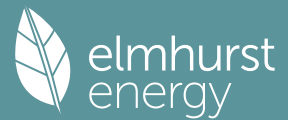
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			2.1000	0.9000	1.8900		(26a)
Windows			19.6000	1.1450	22.4427		(27)
French Doors			15.1000	1.1450	17.2901		(27)
Ground Floor			65.5000	0.1200	7.8600	75.0000	4912.5000 (28a)
Exposed Floor			3.1000	0.2000	0.6200	20.0000	62.0000 (28b)
Wall (cavity)	187.3000	36.8000	150.5000	0.1800	27.0900	18.0000	2709.0000 (29a)
Roof (loft)	66.9000		66.9000	0.1100	7.3590	9.0000	602.1000 (30)
Total net area of external elements A _{um} (A, m ²)			322.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.5518		(33)
Main dwelling							
Internal Wall			210.0000			9.0000	1890.0000 (32c)
Internal Floor			65.5000			18.0000	1179.0000 (32d)
Internal Ceiling			65.5000			9.0000	589.5000 (32e)

Heat capacity C_m = Sum (A x k)
Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 11944.1000 (34)
90.2122 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.0000	0.1440	4.1760
E3 Sill	20.8000	0.0480	0.9984
E4 Jamb	45.2000	0.0640	2.8928
E5 Ground floor (normal)	36.8000	0.0510	1.8768
E6 Intermediate floor within a dwelling	31.8000	0.1300	4.1340
E10 Eaves (insulation at ceiling level)	21.9000	0.0750	1.6425
E12 Gable (insulation at ceiling level)	18.8000	0.0620	1.1656
E13 Gable (insulation at rafter level)	0.0000	0.0620	0.0000
E16 Corner (normal)	40.7000	0.0620	2.5234
R1 Head of roof window	0.0000	0.2400	0.0000
R2 Sill of roof window	0.0000	0.2400	0.0000
R3 Jamb of roof window	0.0000	0.2400	0.0000
E20 Exposed floor (normal)	5.2000	0.3200	1.6640

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Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss

(33) + (36) + (36a) = 105.6253 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.9462	63.8183	63.4585	61.7807	61.7807	60.8711	61.1662	60.5840	61.1662	62.1001	62.4275	63.4585	(38)
Heat transfer coeff	170.5715	169.4436	169.0838	167.4060	167.4060	166.4964	166.7915	166.2093	166.7915	167.7254	168.0529	169.0838	(39)
Average = Sum(39)m / 12 =												167.9218	
HLP	1.2883	1.2798	1.2771	1.2644	1.2644	1.2575	1.2598	1.2554	1.2598	1.2668	1.2693	1.2771	(40)
HLP (average)												1.2683	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9010 (42)
Hot water usage for mixer showers	81.9667	80.7349	78.9399	75.5056	72.9711	70.1447	68.5381	70.3195	72.2723	75.3070	78.8151	81.6527	(42a)
Hot water usage for baths	31.4551	30.9879	30.3301	29.1171	28.2089	27.2018	26.6578	27.3111	28.0223	29.1000	30.3379	31.3488	(42b)
Hot water usage for other uses	44.3387	42.7264	41.1140	39.5017	37.8894	36.2771	36.2771	37.8894	39.5017	41.1140	42.7264	44.3387	(42c)
Average daily hot water use (litres/day)												145.0423	(43)
Daily hot water use	157.7605	154.4492	150.3841	144.1244	139.0694	133.6236	131.4730	135.5200	139.7963	145.5210	151.8794	157.3401	(44)
Energy conte	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565	(45)
Energy content (annual)										Total = Sum(45)m =		2409.1387	
Distribution loss (46)m = 0.15 x (45)m	37.4781	32.9900	34.6702	29.5949	28.0821	24.6459	23.8508	25.1703	25.8574	29.6206	32.4570	36.9535	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	249.8540	219.9336	231.1347	197.2991	187.2141	164.3058	159.0053	167.8021	172.3828	197.4706	216.3800	246.3565	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													
Zero-loss collector efficiency													(H1)
Collector linear heat loss coefficient													(H2)
Collector 2nd order heat loss coefficient													(H3)
Collector loop efficiency													(H4)
Incidence angle modifier													(H5)
Overshading factor													(H6)
Overall heat loss coefficient of system													(H8)
Heat loss coefficient of collector loop													(H10)
Dedicated solar storage volume													(H11)
Effective solar volume													(H12)
Reference volume													(H14)
Storage tank correction coefficient													(H15)
Heat delivered to hot water													(H16)
Heat delivered to space heating													(H24)
Solar input													(H29)
Solar input	-0.6863	-19.8801	-63.3201	-90.5172	-110.7802	-108.1434	-105.3914	-95.8512	-68.3686	-38.9693	-6.7980	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	249.1678	200.0535	167.8146	106.7819	76.4340	56.1624	53.6138	71.9509	104.0142	158.5012	209.5820	246.3565	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	83.0765	73.1279	76.8523	65.6020	62.2487	54.6317	52.8692	55.7942	57.3173	65.6590	71.9463	81.9136	(65)

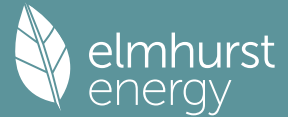
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	174.0572	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.8242	32.7069	26.5991	20.1372	15.0528	12.7082	13.7317	17.8489	23.9568	30.4187	35.5031	37.8477	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	448.6425	453.2980	441.5663	416.5908	385.0638	355.4329	335.6376	330.9821	342.7138	367.6892	399.2162	428.8472	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	55.3067	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	-116.0382	(71)
Water heating gains (Table 5)	111.6619	108.8213	103.2961	91.1138	83.6676	75.8773	71.0608	74.9922	79.6074	88.2513	99.9255	110.0989	(72)
Total internal gains	713.4544	711.1520	687.7872	644.1676	600.1100	557.3441	533.7558	537.1489	559.6037	602.6849	650.9705	693.1195	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.4000	12.7054	0.6300	0.0000	0.7700	51.7724 (74)
East	3.9000	23.7288	0.6300	0.0000	0.7700	44.8923 (76)
South	6.6000	53.5774	0.6300	0.0000	0.7700	171.5365 (78)
West	0.7000	23.7288	0.6300	0.0000	0.7700	8.0576 (80)

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South	15.1000		53.5774		0.6300		0.0000		0.7700		392.4547 (78)	
Solar gains	668.7134	999.5151	1339.5063	1728.6993	1856.8661	1971.3708	1877.9489	1738.5753	1543.7620	1173.3779	805.7085	555.5349 (83)
Total gains	1382.1678	1710.6671	2027.2935	2372.8669	2456.9760	2528.7149	2411.7047	2275.7242	2103.3657	1776.0629	1456.6790	1248.6544 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.4511	19.5806	19.6223	19.8189	19.8189	19.9272	19.8919	19.9616	19.8919	19.7812	19.7426	19.6223
alpha	2.2967	2.3054	2.3082	2.3213	2.3213	2.3285	2.3261	2.3308	2.3261	2.3187	2.3162	2.3082
util living area	0.8843	0.8304	0.7474	0.6231	0.4929	0.3451	0.2415	0.2476	0.4274	0.6522	0.8217	0.8999 (86)
MIT	19.1072	19.4352	19.8887	20.3426	20.6386	20.7983	20.8477	20.8476	20.7487	20.3959	19.7266	19.0528 (87)
Th 2	19.8500	19.8567	19.8588	19.8688	19.8688	19.8743	19.8725	19.8760	19.8725	19.8669	19.8650	19.8588 (88)
util rest of house	0.8692	0.8103	0.7191	0.5844	0.4411	0.2823	0.1687	0.1711	0.3593	0.6040	0.7963	0.8863 (89)
MIT 2	17.6843	18.0884	18.6368	19.1724	19.4990	19.6590	19.6956	19.6996	19.6179	19.2496	18.4631	17.6252 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.9390	18.3294	18.8609	19.3819	19.7030	19.8630	19.9018	19.9051	19.8203	19.4548	18.6892	17.8807 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.9390	18.3294	18.8609	19.3819	19.7030	19.8630	19.9018	19.9051	19.8203	19.4548	18.6892	17.8807 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8377	0.7782	0.6910	0.5663	0.4331	0.2817	0.1706	0.1731	0.3560	0.5846	0.7648	0.8560 (94)
Useful gains	1157.8927	1331.1994	1400.7837	1343.7162	1064.0232	712.2437	411.4401	394.0096	748.6972	1038.2973	1114.0594	1068.8773 (95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Heat loss rate W	2207.0178	2190.8121	1988.5813	1654.2893	1189.0806	743.0690	417.2873	399.7469	803.9834	1300.6749	1779.5526	2144.1043 (97)
Space heating kWh	780.5491	577.6597	437.3214	223.6127	93.0427	0.0000	0.0000	0.0000	0.0000	195.2090	479.1551	799.9689 (98a)
Space heating requirement - total per year (kWh/year)	3586.5186											
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	780.5491	577.6597	437.3214	223.6127	93.0427	0.0000	0.0000	0.0000	0.0000	195.2090	479.1551	799.9689 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3586.5186											
Space heating per m2	(98c) / (4) = 27.0885 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	780.5491	577.6597	437.3214	223.6127	93.0427	0.0000	0.0000	0.0000	0.0000	195.2090	479.1551	799.9689 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	355.9275	263.4107	199.4170	101.9666	42.4271	0.0000	0.0000	0.0000	0.0000	89.0146	218.4930	364.7829 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	249.1678	200.0535	167.8146	106.7819	76.4340	56.1624	53.6138	71.9509	104.0142	158.5012	209.5820	246.3565 (64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	130.8654	105.0701	88.1379	56.0829	40.1439	29.4970	28.1585	37.7893	54.6293	83.2465	110.0746	129.3889 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	32.2320	25.8577	23.2820	17.0574	13.1756	10.7646	12.0192	15.6231	20.2928	26.6253	30.0732	33.1278 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-45.8577	-62.1569	-92.8014	-109.2133	-112.7558	-104.2667	-102.0719	-96.6618	-85.2313	-73.3852	-51.3773	-38.0661 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-13.5826	-26.1384	-57.1647	-102.6351	-138.8819	-160.1757	-155.8467	-130.8398	-91.2646	-47.3725	-19.8424	-10.0204 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												
Space heating fuel - main system 2												
Space heating fuel - secondary												
Efficiency of water heater												
Water heating fuel used												
Space cooling fuel												

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Electricity for pumps and fans:	
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	260.1308 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1927.6103 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	941.0443 (238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1635.4394	26.0600	426.1955 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	893.0845	26.0600	232.7378 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	260.1308	26.0600	67.7901 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-973.8454	26.0600	-253.7841
PV Unit electricity exported	-953.7649	5.8100	-55.4137
Total			-309.1979 (252)
Total energy cost			438.3735 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1635.4394	0.1562	255.4123 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	893.0845	0.1473	131.5418 (264)
Space and water heating			386.9542 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	260.1308	0.1443	37.5449 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-973.8454	0.1347	-131.1293
PV Unit electricity exported	-953.7649	0.1223	-116.6398
Total			-247.7690 (269)
Total CO2, kg/year			187.8270 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1635.4394	1.5782	2580.9948 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	893.0845	1.5449	1379.7259 (278)
Space and water heating			3960.7207 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	260.1308	1.5338	398.9972 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-973.8454	1.4977	-1458.4850
PV Unit electricity exported	-953.7649	0.4486	-427.9016
Total			-1886.3866 (283)
Total Primary energy kWh/year			2594.3553 (286)